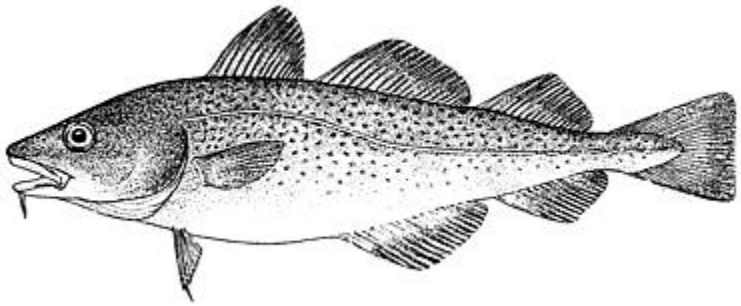
Final Report

Recommendations for Conducting a Collaborative Cod-Tagging Program for New England and Maritime Canada



Submitted May 31, 2001

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Recommendations for Conducting a Collaborative Cod-Tagging Program for New England and Maritime Canada

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On behalf of the New England Aquarium Conservation Department
Based on input from fishermen and scientists

For consideration by the National Marine Fisheries Service and New England Fishery Management Council Research Steering Committee

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Introduction

A number of U.S. and Canadian tagging studies have been conducted in New England and Maritime Canada's coastal waters since the 1920s as reported by Hunt and Neilson (1993) and Wise (1963). One of the more recent studies was the collaborative tagging project by Canadian and U.S. government scientists, which was conducted primarily in the Canadian Gulf of Maine from 1984 to 1997. Recently, fishermen have begun working with the University of Massachusetts/SMAST to tag fish in U.S. waters. However, there has not been a region-wide, federally-funded tagging effort in U.S. waters since Jack Wise's work in 1959.

Based primarily on an analysis of the semi-annual U.S. trawl surveys for the periods 1979 to 1981 and 1997 to 1999, National Marine Fisheries Service (NMFS) scientists have theorized that there has been a pinching down in cod distribution – that fish are compressed into a smaller area. Given the changes in historic abundance levels, and in the environmental and ecological conditions that have occurred over the past forty years since the last tagging effort, the proposed program could provide insight into whether there also have been shifts in cod distribution and migrations. It will augment the synoptic view of cod distributions in the Gulf of Maine, Georges Bank and Southern New England provided by trawl surveys. In addition, because of its large scope, it could help to address some of the data gaps in previous tagging studies.

This program also could provide short-term and long-term information on fish migration patterns, fish movement across closed area boundaries and fish growth rates. Furthermore, if some of the secondary studies are implemented, there is the potential to learn more about: 1) whether closed areas contribute to recruitment and stock recovery; 2) habitat/movement relationships; 3) finer scale inshore movements; and 4) the relationship between inshore and offshore areas.

However, what is precedent setting about this proposed tagging program is that it constitutes the first time that the fishing industry, using industry vessels, will participate as partners in such a broad-scale data collection effort. Through this multi-year program, it is hoped that existing communication barriers over data collection and usage can be overcome and relationships can be established between fishermen and governmental scientists based on trust and mutual understanding. This is particularly critical because a certain level of distrust and resistance to work together still exists among fishermen from various communities and between fishermen and government scientists as evidenced during community meetings.

Overall, the response to the program was quite favorable during the majority of local meetings conducted across New England. In some areas, 20 or more fishermen were in attendance and expressed an interest in participating in the program. Most of the support appeared to be from the inshore fishing community. Part of the reason for the lack of interest from the offshore community may be due to their high operating costs (an estimated $3,000 to $8,000 a day), which would probably make it infeasible for them to participate.

A few members of the fishing community expressed reservations about investing money in a tagging program over other research activities (e.g., otolith studies, genetic studies, etc.). The Task Force concurred that there is tremendous value in conducting other research studies, as tagging fish alone will not answer all questions about cod. It is merely one tool for gathering more information. However, it also was recognized that when considered along with assessment data, genetic studies currently being conducted by New York University, and other existing data, tagging data could contribute to a more complete picture of the cod population. To maximize the value of the tagging effort, the Task Force strongly recommended that when each fish is tagged and recaptured that it also be measured to provide additional information on fish growth rates. It also recommended that fish samples be collected from each of the tag release sites to enable other research studies (e.g., genetics, age and growth, stomach content analysis etc. – See Ancillary Studies, in this report) to be conducted. In addition, the Task Force recommended that some funds be allocated for ancillary studies out of this year's collaborative research monies.

Some of the same fishing interests who expressed reservations about cod tagging in the first place, provided their own list of criteria that they felt must be considered if the cod tagging program is to be successful: 1) data must reside with a neutral non-government entity for a minimum of five years before any data collected from this program are used in policy development; 2) there be tagging consistency and that only scientists on dedicated trips be allowed to tag fish; 3) an analysis must be conducted comparing those tags from dedicated trips and returned by fishermen with those captured by scientists to ensure that the data sets are the same; 4) dedicated and paid tagging trips be used to maximize the number of fish tagged; 5) the program must be long term with assurances of long-term funding commitments; 6) prior to implementation the program design must define where, when and how many fish to tag; and 7) that tagging programs should be designed for all New England stocks.

In the development of this program, the Task Force has attempted to address these concerns to the best of their ability. Specifically, the Task Force is recommending that a neutral, non-government entity be established for housing and disseminating data over the short term; tagging be done primarily on dedicated, paid trips; and the program be long term in scope with the ultimate goal of expanding the effort to include tag ging of other species. It also is providing guidance on where, when and how many fish to tag.

However, while limited offshore vessel participation may necessitate that government scientists work in concert with fishermen to tag fish in offshore areas, the Task Force maintained that the majority of the tagging should be undertaken by trained fishermen. The intent of this program is to foster working relationships between fishermen and scientists and to provide supplemental income to fishermen and a formal mechanism for them to contribute to scientific knowledge. The tagging procedure also is fairly straightforward and will require limited training. Nevertheless, the Task Force still recommends that all individuals interested in tagging undergo basic training and that a local trainer (local coordinator) accompany each fishing vessel on its first tagging trip to ensure tagging consistency.

In addition, the majority of Task Force members concurred that given that the charge of the Task Force was to define a scientifically credible research program, it was not appropriate for this group to make recommendations with management implications. So, it was not recommended that data be held for any set duration before being used in management decisions. A further point was made by one scientist that in rare instances extremely relevant information could be derived from a single fish movement. In addition, since management decisions must be based on "the best available science," any data collected from this program would have to undergo significant peer review by the Stock Assessment Review Committee (SARC) as well as the proposed Clearinghouse Steering Committee before it would be considered by fishery managers.[1]

To further ensure the success of this program, there is a need to increase public awareness in Canada as it is anticipated that a portion of the tag returns will come from Canadian waters (some scientists estimate 20 percent or more based on previous tagging studies). Canadian fishermen must not only be made aware of this tagging effort and support it by returning tags, but also a reciprocal study should be undertaken in Canadian waters. Two members of the Department of Fisheries and Oceans and a member of the Non-Government Organization (NGO) community, the Center for Community-Based Management, have participated as members of this Task Force and have recently been awarded funding to conduct such a study. It is critical that the United States and Canada continue to collaborate after this preliminary design work is complete to ensure the coordination of these two programs should they both be funded.

This program represents the first step in a new direction for large-scale collaborative research in the region. If successful, it can provide a foundation for other tagging efforts and further cooperation among U.S. and Canadian fishermen and scientists. With every new program there may be initial resistance from some sectors, as well as technical issues that must be addressed. But generally, resistance dissipates once the program is successfully up and running (e.g., Oregon State University's FIRST Project, NMFS Southeast Cooperative Tagging Program for Highly Migratory Species and NMFS Cooperative Shark Tagging Program, etc.).

The key is to build and maintain support throughout the duration of the program. A strategic public awareness campaign can help maintain momentum. It must be made clear that the intent of this program is for research purposes -- to gather better scientific information that is understood and accepted by all parties, fishermen and scientists alike. Once the program is implemented more fishermen will begin to realize its benefits: 1) a participatory role in data collection for species on which they base their livelihood; 2) supplemental income; 3) new skills; 4) better information; 5) more timely access to information on individual fish movements; and 6) an enhanced public image of the fishing industry.

[1] Upon review of the Draft Report Recommendations for Conducting a Collaborative Cod-Tagging Program for New England and Maritime Canada, the New England Fishery Management Council urged that as soon as scientifically credible data are available, these data should be readily accessible so that fisheries can be managed effectively.

The first years of this program should be viewed in some ways as a pilot for building cooperation, gathering and turning around information to the fishing community in a timely fashion on individual fish movements and building a detailed, long-term database about cod movements and eventually other species in U.S. and Canadian waters. Ultimately, data collected through this effort can be used to help validate or alter current management measures. But that should not be the focus of this program; rather it should be a byproduct of gathering good scientific information. Lastly, this program should be part of a complementary suite of research efforts undertaken in the region, which together will enhance our understanding of this valued marine ecosystem.

Program Design

Program Objectives

- Develop a collaborative cod-tagging program between fishermen and scientists to build bridges and strengthen working relationships towards improved understanding of marine ecosystem functioning
- Improve understanding of current cod distribution and movement patterns throughout Gulf of Maine, Georges Bank, Southern New England and coastal waters
- Establish a foundation for future U.S./Canada, industry/scientific community collaborations to enhance understanding of shared marine resources (e.g., tagging programs for other species)

Statement of Work

Background

The New England Aquarium was contracted by the NMFS to develop recommendations for a multi-tiered cod-tagging program with corresponding funding levels. To this end, the New England Aquarium assembled a Task Force consisting of fishermen and scientists and held a series of eight Town Meetings with fishing communities in Portland, Maine; Point Judith, Rhode Island; New Bedford, Massachusetts; Gloucester, Massachusetts; Chatham, Massachusetts; Scituate, Massachusetts; Ellsworth, Maine; and Portsmouth, New Hampshire to help define research questions and key design elements of the program.

The following set of recommendations were derived from these discussions: 1) a large-scale tagging effort, using conventional (t-bar) tags in U.S waters in the Gulf of Maine, on Georges Bank, in Southern New England waters and along coastal New England including tagging and tag retrieval inside U.S. year-round closed areas and in Canadian waters; 2) a pilot study using electronic tagging devices inside one closed area; 3) fine-scale movement studies using electronic tags in inshore areas; and 4) a reciprocal Canadian tagging study using conventional tags.

First, the proposed large-scale study will tag and release fish during the spawning season and thus recoveries should represent movement of post-spawning fish. It will sample all major spawning grounds and areas of high cod fish concentration along with some inshore areas, which historically were considered minor spawning areas in the scientific literature and where fishermen are seeing increasing numbers of cod today. In the latter case, Maine fishermen have reported seeing adult fish, over the past three years, in estuaries where they have not been seen for more than two decades.

* ***Please Note:*** *Italicized text denotes Author's Note or points of discussion where no consensus was reached.*

Despite a high interest in understanding the relationship between juvenile and adult distribution and movement patterns, the majority of the Task Force recommended targeting only adult fish and opportunistically tagging pre-recruits (16 to 19 inches) throughout the duration of this tagging program. The consensus within the Task Force was that directed tagging of juveniles along with adults would expand the scope of the program, spreading limited resources over too many projects, thereby reducing the chances of collecting enough meaningful information to answer specific questions about adult movement patterns. Another concern expressed was whether there would need to be a more lengthy process to obtain experimental fishing permits if there was a directed effort to tag juvenile fish. However, it was pointed out that the need for permits might be mitigated if the fish are not retained and are returned to the water in good condition. The rationale for opportunistically tagging only pre-recruits rather than all juveniles was based on the experience of fishermen and scientists who have been involved in other tagging efforts. They found that tagging fish below pre-recruit size was much more difficult and could result in higher levels of mortality.

Nevertheless, fishermen identified spatial and temporal information about areas of juvenile concentration during the Town Meetings (See Figure 5). A hypothesis was even suggested that juvenile fish do not undergo significant movement patterns until they reach maturity. In the event that additional monies are allocated for tagging studies in the future, this list may provide a basis for determining appropriate tag release sites.

(Size range of fish is specified where it was indicated by the fishing industry)

- Southern New England inshore areas (Narragansett Bay) (November to March)
- Little Georges (year round)
- Middle Bank (April)
- Wildcat Knoll
- Massachusetts Bay (in less than 20 fathoms of water, year round, 1 year old fish)
- In Massachusetts coastal waters from Cape Cod to Cape Ann (5 to20 fathoms, year round, but particularly evident in winter)
- In Ipswich Bay (year round)
- Along coastal Maine (February to March, particularly in the last three years, two to three year olds, 15 inches and up)
- Along coast of Downeast Maine, around Vinal Haven and into Bays including Penobscot, Cobscook and Passamaquoddy (in shoal waters, out to 40 fathoms in winter months, reported to be filled with worms)

- Sheepscot River (most prevalent April to June)
- Casco Bay (most prevalent April to June)
- Cashes Ledge
- Along Jeffreys Ledge (northern section). Some fishermen refer to this as "the incubator."

Second, a recommendation also was made by the Task Force for a smaller-scale study of year-round closed areas using electronic tags. This study would seek to answer more specific management related questions raised by the fishing industry during the Town Meetings. The industry was most interested in learning the value of closed areas and whether these areas constituted sinks (whether fish go in, but nothing comes out) or sources of recruitment and stock rebuilding.

Another advantage to this smaller-scale study is that it provides an opportunity to gather much more detailed information such as pressure and temperature, which can further aid in understanding not only where and when fish move, but why they move. It may provide new information about the relationship between habitat, in terms of environmental and oceanographic conditions, and fish movement patterns. Given the high cost of electronic tags, it is necessary to develop a more strategic approach to their deployment. This pilot project provides a cost-effective means to evaluate the use of electronic tags and to test the scientific methodology and sampling protocol. Contingent on the success of this initiative, and as costs of electronic tags come down, there may be the possibility of broader-scale application in the future.

Third, some members of the Task Force expressed an interest in understanding the role of coastal spawning areas, finer-scale movement patterns within these areas and the relationship between inshore spawning areas and larger, offshore spawning grounds. Some scientists and fishermen suggested using electronic tags in these localized studies as well. During the Town Meetings the fishing industry provided input on local movement patterns and suggestions for focus areas for smaller-scale studies.

Lastly, recommendations were made that a complementary tagging effort also be conducted by Canadian fishermen and scientists on Georges Bank/Coastal Nova Scotia, Browns Bank and in the Bay of Fundy.

Primary Study Research Questions

1. Are there multiple cod stocks throughout New England and southern Canadian waters?

2. Do they undergo movement patterns between areas on a seasonal or other cyclical basis? (*Having a broad question like this allows individual project proposers flexibility in defining their own research questions. For instance, some of the specific interests identified during Task Force Meetings and Town Meetings could be asked and still contribute to answering this broader question such as: Are there movements between inshore and offshore areas? Do fish undergo significant northward migrations in the summer months?)*

3. What is the rate of exchange between these areas? *(This is a more long-term question, which seeks to quantify movement patterns. It has management implications. Before it can be answered, program participants will have to answer the first two questions, which help to qualify movement patterns.)*

It is recognized that past studies have provided some meaningful information to help answer these questions. However, the coastal and marine ecosystem is a dynamic environment and there has not been a recent wide-scale tagging effort in U.S. waters. The question remains as to whether historic movement patterns of cod have changed. In addition, given the inherent distrust that exists on the part of the fishing industry over the current scientific information used to define stocks and fish movement patterns, it is imperative that a collaborative effort be undertaken between fishermen and scientists who are working together as partners to collect this information which will either validate current scientific evidence or demonstrate that there have been changes since the last U.S. tagging efforts in 1959.

Primary Study Deployment Options

For the primary study, three options are presented concerning the number of conventional (t-bar, floy) tags that could be deployed in U.S. waters. Option #1 is to deploy 25,000 tags primarily over a seven-month time frame when the thermocline is not a limiting factor; Option #2 is to deploy 50,000 tags over roughly a seven-month time frame; and Option #3 is to deploy 100,000 tags over a two-year time frame (50,000 tags per year).

The proposed tagging levels were derived from methodology developed by Robinson and Regier (1964). Assuming that the putative cod stocks are one group or a stock complex consisting of 50 million individuals, the requirements are as follows:

For 1-alpha=.95, p=.5 (assuming 50 million individuals) should be marked with 25,000 tags.
For 1-alpha=.95, p=.25 (assuming 50 million individuals) should be marked with 40,000 tags.
For 1-alpha=.95, p=.1 (assuming 50 million individuals) should be marked with 100,000 tags.

This range represents various levels of precision from what the authors call "preliminary to management to research studies." In other words, 25,000 to 100,000 tags is the range of marks as defined for doing population estimates. It would suggest less than 25,000 may be too few under most sets of assumptions and that in excess of 100,000 may be unnecessary. As this methodology is used for estimating population size, it requires a higher level of scientific rigor than may be necessary for conducting a tagging study to merely examine movement patterns. Nevertheless, since a key criticism of past U.S. tagging efforts is that there were extremely low return rates for some tagging sites, these higher deployment levels may yield a higher return rate per area and more statistically meaningful data.

Option #1 is in line with Canadian government plans to deploy 20,000 tags in Canadian waters to coincide with the proposed U.S. program. It also is within the range of past regional tagging efforts (20,000 to 25,000 tags). Options #2 and #3, provide a higher level of precision and if the NMFS and the New England Fishery Management Council (NEFMC) would like to gather additional information to develop an independent estimate of stock abundance, they may be more viable options. However, achieving the latter will require some targeted recaptures of fish soon after they are tagged and released. It also may be necessary to gather additional ancillary data (e.g., genetics studies, age and growth studies) to complement tagging data to refine this estimate. Some genetics studies already are being conducted in the Gulf of Maine and on Georges Bank, at an estimated cost of $100,000 annually, which should be continued and possibly expanded into coastal areas. The Task Force felt that it was critical that, at minimum, age and growth studies be conducted along with tagging for this program regardless of the level of tagging effort. Furthermore, if age and growth studies and possibly other ancillary studies are conducted, this could reduce some of the resistance to investing in a tagging program by addressing some concerns over the perceived value of tagging data alone.

There is some justification for deploying a higher level of tags -- seriously considering Options #2 and #3. First, the collective expertise (some 186 fishermen and scientists, many of whom are currently involved or have been involved in tagging projects) that attended Task Force and Town Meeting discussions recommended deploying, at minimum, 50,000 tags over the entire region. Second, the area to be covered is quite a bit larger than the area in the proposed Canadian program. Third, a higher level of tags deployed will enable a minimum of 5,000 tags to be deployed at 10 locations throughout U.S. waters, likely resulting in a higher return rate which will yield more statistically significant results. Lastly, this will enable program implementers to provide supplemental income to more fishermen because more fishermen will be needed to complete the tagging.

The Task Force also concurred that tagging in a second year would not only further enhance the precision of the tagging study results, but also provide valuable information on intra-annual variability, providing justification for why Option #3 also may be worth considering. In addition, several Task Force members maintained that 100,000 tags would provide much more detailed information about fish movement and distribution patterns and likely result in an even greater return rate.

The tags should be distributed in the Gulf of Maine, on Georges Bank, in Southern New England waters and along coastal New England primarily during the months of November through May to capture the majority of the pre-spawning and spawning aggregations. Furthermore, this time of year is thought to be the best time of year for tagging to maximize fish survival rates as water temperatures are cooler, there is no thermocline and fishermen can avoid bringing fish on decks during warmer summer months. One scientist suggested developing methodology to identify ripe-and-running fish. He maintained that in some areas feeding and spawning fish may be intermingling. The duration of the program should be for a minimum of five years (preferably two years for actual tagging and three years for tag collection and preliminary analysis). According to Canadian government scientists experienced in cod-tagging efforts, the majority of the data will be retrieved over this timeframe: roughly 40 percent can be expected in Year 1; 20 percent in Year 2; 10 percent in Year 3; 5 percent in Year 4, etc. (personal communication with Donald Clark, Department of Fisheries and Oceans, 2001). However, it is expected that a small portion of tags may remain at liberty for a number of years. A mechanism must be in place for addressing tag returns should the program cease after five years.

In addition, a complementary study should be conducted in southern Canadian waters, which include northern portions of Georges Bank/the waters around southern Nova Scotia, Browns Bank and the Bay of Fundy. These three areas have been identified as genetically distinct stocks (Ruzante et al., 1998). Canadian government scientists who are serving on this Task Force have recently been funded to deploy 20,000 t-bar tags on various sized fish and reproductive stages at five or six sites within these broader areas. Of note are their plans to tag fish in Canadian waters adjacent to the Gulf of Maine. This is an area where Canadian fisheries have expanded in recent years and an area where further research may be warranted to provide a more realistic indication of stock affinity (i.e., the relationship between fish found in eastern Gulf of Maine waters and adjacent Canadian waters).

The U.S. may want to provide 25,000 tags (at a cost of $ 13,750) for use in the Canadian study to ensure consistency in tags deployed and as an incentive for Canadian government support for a bilateral program. Whether or not the tags are provided by the United States, it is essential that should these programs both move forward, the same tags be used in each program. In addition, all tags should include a 1-800 phone number and both U.S. and Canadian return addresses. Just as there may be reluctance on the part of some U.S. fishermen from various regions to turn in tags, there also may be reluctance on the part of Canadian fishermen to turn in tags for a U.S. program. Providing Canadian fishermen, who most likely will capture a portion of the tag returns, with a 1-800 phone number and a national point of contact to which questions may be addressed may reduce some of the apprehension to turn in tags.

Furthermore, where possible, consistent recommendations have been made in the tagging program design for both programs (e.g., some of the Canadian program methodology has been adopted in this report and Canadian scientists also have incorporated elements of Task Force discussions in their tagging program design). As the U.S. and Canadian programs are implemented, it is important to ensure continued

collaboration, perhaps requiring that all individuals who tag fish be trained in a consistent tagging technique and data collection protocol. Federal officials are encouraged to work together to help ensure that this happens.

U.S. Tagging Locations

Tagging Studies should be conducted during the spawning season to capture migration patterns of the adult population in four regions: Gulf of Maine, Southern New England, Coastal waters and on Georges Bank. According to the Essential Fish Habitat Source Document for Atlantic Cod*, Gadus morhua*, spawning occurs year round with a peak in winter and spring. Within these broader geographic regions some potential tagging locations* and timeframes include:

GEORGES BANK REGION *(25-35 fathoms of water)*	
Northern Edge of Georges Bank	First Quarter, 2002
Along the Hague Line	Fourth Quarter, 2001
Great South Channel	First Quarter, 2002
SOUTHERN NEW ENGLAND REGION	
Coxes Ledge Vicinity	First Quarter, 2002
Nantucket Shoals	
(7-20 fathoms)	Fourth Quarter, 2001
GULF OF MAINE REGION	
Massachusetts Bay/	
Stellwagen/Middle Bank	
(10-50 fathoms)	Fourth Quarter, 2001
Fippennies (southwest)	First Quarter, 2002
COASTAL WATERS REGION	
Ipswich Bay (25-50 fathoms)	First Quarter/Second Quarter, 2002
Casco Bay	End of First Quarter/and beginning of Second Quarter, 2002, to capture spawning fish
Mt. Desert Rock/	End of Fourth Quarter, 2001/First Quarter/and
Penobscot Bay	beginning of Second Quarter, 2002

* This list is not to meant to be definitive, particularly with respect to coastal waters. If a persuasive case can be made by individual project proposers during the NEFMC Research Steering Committee/NMFS Request for Proposals (RFP) process a number of other areas could be considered as tag deployment sites, as suggested in the following pages of this report.

Rationale for tagging location selections

The ten tagging locations were selected in an attempt to ensure a widespread dispersal of tags and sample inshore and offshore areas. When funding local projects, program implementers should consider such a strategic allocation of resources to ensure adequate regional coverage. In most cases, these areas represent either major or minor spawning grounds according to historic literature, recent spring/fall trawl survey data and input from the fishing community during Town Meetings, Task Force discussions and one-on-one interviews.

The three Georges Bank locations identified, the northern edge in November through April (primarily January to April), along the Hague Line in November through April and in the Great South Channel in November through April (primarily February and March) are intended to capture major aggregations of spawning fish in this region. In Bigelow and Schroeder (1953) specific latitude and longitude coordinates were given (Lat/41º 21' to 41º 31'; Long/65º 50' to 67º) in waters less than 35 fathoms on Georges Bank. It would be interesting to see if concentrations of fish still are found at these specific coordinates. In addition, a small number of tags were deployed along the Hague Line during the Canadian tagging effort in the 1990s. Additional tagging in this area may further substantiate the preliminary findings of this latter study. Fishermen report seeing fish year round in the Great South Channel. Tagging in these locations will help to answer questions raised by fishermen and scientists about fish movement patterns into Canadian waters to the west, movement between Georges Bank and Southern New England waters (believed to be fairly substantial), the use of the Great South Channel as a migratory route north into coastal waters and whether there are other significant movement patterns which have not be detected. It also will provide some information about when these migrations are occurring. Furthermore, since two of the tagging locations are inside a closed area this will help satisfy the fishing industry request to learn more about how cod are using closed areas. In the case of the northern edge tagging location more can be learned about movement patterns into and out of the Habitat Area of Particular Concern.

The Northeast Peak of Georges Bank clearly continues to be an important area for cod spawning. Since it is in Canadian waters, it is hoped that the Canadians will include it in their tagging program.

In Southern New England waters, Coxes Ledge and Nantucket Shoals have been identified as potential tagging locations. Fishermen report the presence of cod year round on Coxes Ledge and it has been suggested that some spawning may be occurring in this area. According to the most recently published government assessment, egg densities are the highest in the general area around Coxes Ledge from November to April. Specifically, some local fishermen identified a swath of water from Block Island, southwest to Coxes Ledge and northeast to No Mans Land and Martha's Vineyard as areas where cod are present year round in small numbers. Spawning fish are reported to be around Nantucket Shoals from November through March. Bigelow and Schroeder (1953) identified Nantucket Shoals as an important spawning ground for Southern New England. Today, some fishermen maintain that

there are very few fish in the vicinity of Nantucket. Government surveys indicate that the highest concentrations of adult fish and eggs during winter and spring are found in the southwestern portion of Nantucket Shoals and to the west in the Great South Channel, up along the coast of Cape Cod from Chatham to Provincetown and into Massachusetts Bay as well as to the east along the Rhode Island coast.

Based on tagging studies conducted by Schroeder from 1923 to 1929, length frequency studies and sclerite counts of scales, it was thought that the stock of cod living on Nantucket Shoals was for the most part distinct from that of fish living to the north and east. Fall migrations were documented to Rhode Island and North Carolina. Schroeder also documented eastward movements to Chatham and the Great South Channel during certain summers. He further documented a relationship between Georges Bank and Southern New England waters which was supported by later tagging efforts. Much more needs to be learned about the relationship between Southern New England and Georges Bank and how much interchange takes place between these areas as well as about the number of fish moving northward along Cape Cod and into Massachusetts Bay. Tagging fish in the vicinity of Coxes Ledge and on Nantucket Shoals will enhance understanding of these and other critical relationships. It will provide some information about the interchange between Southern New England and Mid-Atlantic fish.

While there may be a case for tagging in both these locations, proposal reviewers are asked to remain open to other suggested locations put forth during the RFP process, provided the rationale for tagging in other locations is well substantiated (e.g., Nantucket Lightship).

A review of the scientific literature regarding the Gulf of Maine indicates that the major spawning grounds for this region can be found in Massachusetts Bay. Current trawl surveys indicate that Massachusetts Bay has large numbers of adults and high egg concentrations during the spring and fall seasons (highest egg concentrations are found here April through June and November through February), further substantiating Massachusetts Bay's value as a key spawning location today. Fishermen report seeing cod in these waters year round. Some fishermen have hypothesized that fish in these areas undergo a mini-circular movement pattern, mixing with fish from Southern New England and central Gulf of Maine waters. Tagging in Massachusetts Bay/Stellwagen (Middle Bank) may shed some light on movement patterns between this area and southern waters as well as between coastal areas to the north and with the eastern Gulf of Maine. Another possible tagging location in the Gulf of Maine is Fippennies Ledge. The area just to the southwest of Fippennies Bank appears to be an area where a reasonable number of adult fish are found in both fall and spring surveys in recent years. According to the most recent government surveys there appear to be low concentrations of eggs around this general area in late winter, spring and summer months, particularly around March/April, suggesting that some spawning activity may be occurring in this vicinity. Further rationale for tagging in this area is that prior tagging studies were conducted here, so information collected from the current program could be compared with previously collected data.

Other tagging location possibilities within the Gulf of Maine include Jeffreys Ledge and Cashes Ledge. Today, some fishermen believe that Jeffreys Ledge, which historically was considered a feeding area, may serve as a "staging area," where pre-spawning fish gather before moving inshore to spawn. Furthermore, fish are caught year round in these waters and as previously stated the northern portion of the Ledge may be a key habitat for juveniles. Given the importance of this area and scientific theory that with lower overall abundance, cod have retreated to areas of higher habitat value, tagging on Jeffreys Ledge has merit. Tagging fish on Cashes Ledge may be worthwhile to gather more information about movement among eastern, western and southern portions of the Gulf of Maine. It clearly is an important area for juvenile cod, but it is not believed to represent a major or minor spawning location. Nevertheless, it was a deployment site in previous tagging studies and the return rates were exceedingly small, so a case could be made for why it is valid to retag in this area.

During Town Meeting and Task Force discussions, Platts Bank also was identified as a possible tagging site within the Gulf of Maine. Historically, this area was identified as a feeding area not a spawning area. During the Town Meetings a few fishermen expressed concern over tagging feeding fish – stating that generally they are more vulnerable and may require special handling to improve survival rates. However, another fisherman reported that it is really an issue of what the fish have been eating that makes them vulnerable and how long the fish are on deck. He emphasized that if fish are dead, they are more susceptible to decomposition by the acidic content of the feed and ruptured stomach cavities. He also maintained that there are drawbacks to tagging just spawning fish as well -- namely that they are not as susceptible to all capture methods limiting program participation to only a few gear types. Recognizing that spawning fish may be unwilling to take baited hooks, it also has been proposed that tagging be conducted on pre-spawning aggregations. While there certainly are valid arguments for targeting fish in other locations and at other times, in an effort to keep this program reasonable in scope pre-spawning and spawning aggregations were identified as the initial focus. If the program is successful and additional monies are forthcoming, perhaps the number of tagging locations could be expanded to include feeding areas such as Platts Bank, Franklin's Swell and other key habitats.

Tagging in coastal waters was of great interest to the fishing community. Further rationale for focusing some tagging effort in these areas is that historically coastal spawning may have contributed a great deal to the Gulf of Maine fisheries, some estimate contributions as high as 80 percent (Island Institute, 1997, Ames in press). In the Coastal Region, three locations have been identified which are believed to represent spawning grounds according to the scientific literature and fishermen's reports: Ipswich Bay, Casco Bay and Mount Desert Rock/Penobscot Bay. Ipswich Bay, south of the Isles of Shoals to the mouth of the Merrimack River in 25 to 50 fathoms, continues to be a center of spawning activity for cod. Generally spawning is believed to occur here in late November through July (months with highest egg concentration include: February, April, May, June and July). Fishermen report the best time to tag fish would be April and May in the northern areas of the bay. Casco Bay was listed as a minor spawning ground in Bigelow and Schroeder (1953) and is an area where fishermen are once again starting to see codfish. Fishermen report that spawning is occurring in these waters

during May and June when the rolling closure is in place. It may be possible to tag fish in April, when fish are starting to aggregate or this may be one area that requires tagging during warmer months, May and June. Relative abundance estimates found in the Essential Fish Habitat Source Document for Cod indicate that all life history stages are present in Casco Bay further supporting the notion that this is a spawning ground. Ames (in press) also cites Eastern Casco Bay as an area of spawning activity.

Mount Desert Rock could be another key coastal tagging location. Bigelow and Schroeder (1953) identified Mount Desert Rock as minor spawning ground. Spawning may occur here in late fall or early winter and again in the summer months. MARMAP surveys (January toDecember,1978 to1987) show egg concentrations in this area, with peak months being October to January and May to July. Extensive tagging was conducted here from 1923 to 1929 (some 6,000 tags were deployed with an estimated 20 percent return rate). However, no results of this work were ever published. The little information that was shared stated that fish tended to stay in the tagging locality with a few wanderings eastward. Some fishermen who fish in this area have stated that they also believe a portion of the fish move northward into Canadian waters and west into Penobscot Bay. Fishermen report that there also is spawning activity in Penobscot Bay. Perhaps given its close proximity to Mount Desert Rock, a portion of the tags allocated for this area could be deployed inside the bay to examine the relationship between these two areas as well as to more clearly pinpoint spawning activity today. Tagging efforts in this area would be further complimented by the long-term oceanographic studies that have been conducted in the bay by the Island Institute.

Tagging in the proposed coastal locations may help to further understanding of movement patterns between inshore and offshore spawning grounds. Furthermore, these three coastal locations were suggested in an attempt to deploy tags to ensure the broadest possible geographic representation. However, there are certainly other locations and times that could be considered beyond what has been proposed here. For instance, there are numerous minor spawning grounds cited in the scientific literature along coastal Maine including off Cape Elizabeth (Bigelow and Schroeder, 1953); off Boothbay (Bigelow and Schroeder, 1953); in the mouths of Cobscook and Passamaquoddy Bays (Fishing Industry, 2001, Bigelow and Schroeder, 1953, Island Institute, 1997,); in Saco Bay (Department of Marine Resources, Trawl Surveys, early 1990s), near Wood Island, off the mouth of the Saco River (Fishing Industry, 2001); and in Sheepscot River (Fishing Industry, 2001, Island Institute, 1997, Bigelow and Schroeder, 1953). In the latter case, a long-term tagging study was conducted by the Maine Department of Marine Resources from 1978 to 1983 with the majority of the recaptures made along the coast and in reasonable proximity to the tagging location (Perkins, et al. 1997). However, some fish were reported to move into Ipswich Bay in mid-winter. There may be some value to retagging in the Sheepscot River to confirm movement patterns and see what, if any, changes have occurred over the past eighteen years since that survey was concluded. Another area that was identified by Massachusetts' fishermen during one of the Town Meetings was Cape Cod Bay. According to fishermen there are aggregations of “whale” cod in the spring in Cape Cod Bay. Rhode Island and New Hampshire fishermen may know of other areas where

tagging should be conducted. The key is that there is a large enough number of fish present to tag and ensure a statistically significant return rate.

Tagging Methodology

While it is expected that various local projects operating under the umbrella of a larger-scale tagging program will develop project specific methodologies, the following is meant to provide some basic guidelines that should be incorporated into these respective projects to ensure overall consistency in data collection.

Spatial and temporal tag release sites should be determined based on areas of high catch rates in government research vessel surveys as well as the location and timing of historic cod spawning activity. Some further analysis of previous tagging studies to identify data gaps also may be worthwhile. Prior to tagging, fishing trials should be conducted by the industry survey vessels to identify areas, which are currently yielding both high catch rates and at least 50 percent cod composition. In published tagging studies, as few as two and as many as 11,000 tags have been deployed per tagging location, usually over multiple years (Wise, 1962, Hunt et al, 1998). The Task Force recommended that between 5,000 and 10,000 tags should be deployed per site in order to yield statistically significant information on movement patterns. Given the lower abundance of codfish in coastal waters it may be more appropriate to deploy 5,000 tags in each of these tagging locations as tagging 10,000 fish may not be possible. To maintain program consistency, it may be prudent to tag 5,000 fish in each of the 10 proposed tagging sites. The fact that the majority of previous tagging studies marked lower numbers of fish in their respective study areas suggests that to achieve reasonable results would not require that more tags be deployed in any given area.

Program implementers may want to consider that when conducting fishing trials to identify survey sites, they should avoid areas of high concentrations of skates (*Raja* spp.) and dogfish (*Squalus acanthias*). Their abrasive skin resulted in damage to cod and poor quality specimens for tagging in a study by Hunt et al. in 1998. However, researchers may want to weigh the value of collecting ancillary information regarding predator-prey relationships before shifting to other locations to tag fish.

Once an aggregation of cod is located, tagging will typically continue at the site for a period of one to two days (Hunt et al. 1998). Currently there are at least 80 U.S. fishermen who have been identified as having an interest in participating in this cod-tagging program. Most have expressed a willingness to participate in the tagging effort for at least one-day a month in the first year of the program. During the Town Meetings, fishermen indicated that if they were on a dedicated trip, they could tag 100 fish a day. This is corroborated by the recent Canadian tagging effort where 100 to 250 fish were tagged successfully in a given day (Hunt et al., 1998). This would provide a sufficient amount of effort to implement this program. Follow-up calls should be conducted to individuals listed in Appendix 2 of this report as a starting point for identifying fishermen to participate in local projects as many of them expressed an interest in participating in this cod-tagging program.

The vast majority of fishermen surveyed supported the notion that vessels under 60 feet should be compensated in the amount of $1,500 (two-man crew) a day for a dedicated trip. However, it should be noted that the going rate paid for fishermen to participate in research projects ranges from $500 for a dedicated trip and $2.00 per returned tag (SMAST, tagging effort) to $2,200 a day (University of Maine research project). *One scientist pointed out that when fishermen agreed to this day rate of $1,500 they might not have considered the added costs of bringing a person onboard to train them in the tagging effort. Specifically, trainers will have to be provided with a survival suit and there may be added insurance costs for fishing vessels carrying an extra person. To ensure that $1,500 is a reasonable rate, the cost of survival suits for all trainers has been added to the overall tagging program budget (see attached budget). In addition, it is not anticipated that fishermen will incur any added insurance costs. However, several members of the fishing community who are currently involved in tagging emphasized the need for a three-person crew to successfully tag fish, which may or may not require increased vessel funding.*

During subsequent one-on-one interviews with two members of the recreational fishing industry and a member of the commercial fishing industry in New Hampshire and Rhode Island a point was raised that rather than a lump sum being paid to fishing vessels for tagging fish, perhaps payments should be made per fish tagged. In Rhode Island, the concern was that it might be difficult to tag 100 fish a day, due to low cod abundance, unless fishermen are tagging in the Great South Channel. The Task Force had discussed this idea, but felt that a flat fee still was the best option to more adequately compensate vessels for operating costs and avoid the potential for misreporting.

Recognizing that there may be a limited number of larger, offshore vessels that are interested or can afford to participate in this tagging effort, it has been recommended that a portion of the tagging in offshore areas be conducted by government survey vessels (federal and/or state) as part of regular spring and fall surveys to minimize costs. However, fishermen should serve as part of the crew to tag fish during these surveys. *A recommendation was made by a small group of fishermen that a separate study should be conducted, where scientists would do the tagging. This was viewed as a means to ground-truth data collected by fishermen. However, others expressed fears that should such a study be implemented, it could undermine the fishing industry tagging effort (implying that the data that fishermen are collecting are not credible). The majority of the Task Force maintained that this program was meant to provide an opportunity for fishermen, so primarily fishermen should conduct the tagging. However, if there are a lack of offshore vessels interested in participating in this program and the only means of sampling these areas is via government survey vessels then this concern may be addressed indirectly.*

A variety of fishing methods should be used to capture and tag fish so standard protocols must be followed to maximize fish survival. According to Canadian scientists, it may be best to charter otter trawlers during spawning as fish are less likely to take a hook. When otter trawls are used, tow duration should be no longer than 20 minutes (some fishing industry members suggested 10 minute tows), the trawl must be retrieved slowly and the cod end should be kept fairly loose as it is pulled in to reduce trauma to

the fish. When using gillnets, length of sets should be kept to a minimum -- no more than four to six hours in duration. With both these gear types, fish must be emptied into a holding tank with running water and observed to be in good condition before tagging. Cod are to be measured, tagged and immediately released. Cod captured with hook-and-line or lobster pots/traps should be processed immediately and need not be held in an on-board tank. Total elapsed time, from start to finish, for tagging fish should be kept to a minimum. Canadian scientists found that the entire tagging procedure took no more than 30 seconds and maximized fish survival. Fish should be tagged along side the leading edge of the first dorsal fin.

Fishermen are to record, at minimum, the following information on waterproof paper as part of standard tagging operations and to ensure consistency with data being collected in the Canadian fishery: position, date, time, fish length and tag number. It also would be worthwhile to collect depth, temperature and bottom type information. These data will then be transferred to spreadsheets and eventually entered into a relational database. Database structure should be consistent with Canadian researchers, so that a common database for all tagging can be maintained.

There was complete consensus by the Task Force and during Town Meeting discussions that fish should be tagged in areas where gear closures are in place. A variety of suggestions were made for how to access these areas. For instance, most fishermen supported the idea of allowing commercial groundfish vessels on dedicated trips, with an exempted fishing permit, access to the areas to tag fish. However, some members of the recreational fishing community expressed reservations about this idea, urging that only fisheries currently allowed to operate in the areas be involved in the tagging effort inside these areas. Given that it can take at least 45 days to obtain an experimental fishing permit another suggestion was made that commercial fishermen could simply fish as recreational fishermen, provided they did not use any of the restricted gears and adhered to recreational fishery regulations (e.g., can not sell any fish, allowed to keep only ten cod or ten haddock or ten yellowtail flounder, or any combination thereof, uses only two hooks per person, where a treble hook counts as two hooks, no one is charged for fishing and all restricted commercial fishing gear is properly stowed). According to the NEFMC, there are some regulatory and management considerations for commercial fishing vessels. For instance, limited access vessels are required to sign out of a commercial fishery for a minimum of three months to be allowed to fish as party or charter vessels.

There was some support for encouraging the participation of the lobster fishing industry and recreational (charter boats) industry to gather data from closed areas. Many felt that it would be reasonable to compensate lobster boats and charter boats which were willing to tag fish during their regular fishing activities (e.g., covering cost of fuel or paying charter boats some sort of small fee -- $200 to 300 per day or allow each boat to retain one fish). These boats might be able to gather supplemental information to compliment the data collected during dedicated trips as well as additional information on juveniles. A recommendation also was made during a few of the Town Meetings to have lobster boats paid for a dedicated trip to fish for cod using hook-and-line in these areas and in other areas such as Downeast Maine where there are very few groundfish

vessels left. It was added that having lobster boats on dedicated fishing trips using hook and line gear would ensure that fish were in better condition. In some instances if adult cod are caught during regular lobster fishing operations, they can be damaged by the lobsters in the traps.

Tag returns

Just as basic biological information must be gathered when fish are tagged, some complementary information also must be collected when tags are returned. It is important to collect information on date, location, gear type and fish length along with the tag return. The proposed Canadian study plans to distribute tag return envelopes to fishermen. These printed envelopes will include categories (e.g., date, location, gear type, etc.) to prompt fishermen to record pertinent information. This may be a worthwhile investment for the U.S. program because having these envelopes onboard vessels may increase the likelihood of tags being returned with corresponding information. It is recommended that an information package including details about the program's goals and objectives, contact information for returning tags and return envelopes be distributed to all federal permit holders. To ensure consistency in fish measurements, it also may be appropriate to include a standard measuring board in this package.

In addition, providing fishermen with timely information on individual fish movements via follow-up mailings and offering various incentives may further enhance the number of tag returns. Receiving prompt feedback on recaptured fish, regular progress reports and access to some of the data through the Internet are expected to build and maintain interest in the program and improve tag return rates.

Since others likely will return tags including scientists, recreational fishermen, party and charter boat operators, it may be cost prohibitive to supply them with envelopes and unreasonable to expect that they would be willing to collect additional information beyond the tag itself. At minimum, attempts must be made through various means to raise their collective awareness of the program and encourage them to turn in tags (See *Outreach Program* for details). Suggestions were made to provide a variety of incentives (e.g., hats, an annual lottery and/or a fee per returned tag).

A 1-800 number should be established that is free to both Canadian and American callers to further enhance the number of tag returns. If a fee were paid per tag, fishermen and others still would be required to mail in the tag.

A return rate of roughly 10 percent is expected based on experiences with past tagging efforts. Higher return rates may be possible (as have been obtained in a few previous area tagging studies) if enough support can be built for the program.

A representative sample of whole fish from each tagging site also should be collected as part of this program for future analysis (e.g., 100 fish per tagging site).

Training Program

A one-day, comprehensive training program should be conducted to ensure that all local projects are conducted in a consistent manner. If the actual tagging effort spans two-years then the training program should be conducted twice because there likely will be a need to train additional trainers.

The purpose of this training session should be to provide an overview of the program infrastructure (e.g., role of Clearinghouse) to individual Project Managers and local coordinators/trainers; share information about tagging technique; and provide some hands-on training for trainers in proper capture, handling, tagging and release protocols. Once trained these "trainers" would be responsible for conducting local training sessions with vessel captains and their crew who are involved in the actual tagging operations. Trainers should be required to accompany vessel crew on the first tagging attempt to ensure that they have mastered the tagging procedure. According to fishermen and scientists experienced in tagging, the procedure is fairly simple. It should be sufficient to have trainers accompany crew on a single trip to ensure that they have mastered the tagging procedure. It is critical, given the number of individuals who may be involved in the tagging effort, that consistency be maintained in tag deployment to minimize the variability in tag retention.

A training video and background materials should be developed for use in the local training sessions. Brochures should be distributed to provide a "quick review" of tagging procedure.

Ancillary Studies

There have been a number of tagging studies conducted here and elsewhere in the world. Many of these explored various means for addressing the issue of tag shedding through double tagging in the wild and lab experimentation. It is recommended that program implementers review the results of these studies and consider whether it is necessary to incorporate a tag shedding experiment into the scope of their respective projects (cost estimates provided in attached budget).

There are currently a few ongoing studies that will further aid in understanding cod stock structure. For example, The New York University is conducting a study that looks at genetic differences between cod from Georges Bank and Gulf of Maine. A pilot study examining otoliths in the Gulf of Maine found different levels of magnesium and lithium in fish from these two areas. If there is a change in the ratio as animals' age, it can be assumed that they are moving outside their respective areas.

Specific studies that the Task Force viewed as imperative to complement overall tagging program efforts include:

- Tag loss/differential mortality of tagged fish – need to consider a shedding experiment to assess survivability;

- Obtain a representative biological sample from each area to (e.g., need, at minimum, 100 individual fish per area of interest);

    - confirm age structure (otolith);

    - conduct analysis of the fin clip for genetic differences;

- Confirm maturity state (Could have a biologist dissect the fish on the deck of the boat or conduct analysis on fish sample in the lab. Fishermen also could be trained to do this. In previous Canadian tagging studies, fishermen were provided with a booklet to help them determine maturity state);

- May want to collect information on surface water temperatures, season, bottom type and depth. May want to overlay with information collected from USGS or have fishermen collect as part of their daily/trip report; and

- Species co-occurrence via belly samples also may be of value. However, a few Task Force members pointed out that quite a bit of work already has been done on stomach content analysis to date.

It further was recommended that if monies are not diverted from this tagging effort to complete these ancillary studies, then the Sentinel Fisheries Program (Industry-based Surveys) should consider conducting them under its purview as a complement to this effort.

In addition, the Task Force identified some questions that would require more information on predator-prey relationships and habitat usage. These questions included

- What is role of habitat in relation to cod movement patterns and distribution? What can we learn about particular habitat utilization? Are there specific habitat types that can be associated with movement patterns? What about the role of shipwrecks, bottom types, salinity, water temperature, etc.? (*Some of this information could be gathered if secondary studies listed in this report also are conducted);*

- What is the relationship between adult fish and juvenile fish? (*This will require looking at kept fish vs. discards);*

- Is there a presence or absence of feeding fish such as herring?

- Are the closed areas producing spawning fish? *(The proposed studies will begin to answer this question);*

- Is there spawning site fidelity? *(The proposed large-scale tagging program would begin to answer this question, but it would require tagging over multiple years); and*

- What about the role of predator-prey relationships (e.g., dogfish)? *(This will require recording catch summaries).*

Secondary Studies

Closed Areas

1. Are closed areas sinks or sources of recruitment/rebuilding?

The primary tagging study can begin to examine the question of whether there is emigration from these areas if conventional tags are released inside closed areas. To help answer this more specific management-related question a small-scale study using electronic tags is recommended.

While Closed Area II would be sampled during the wider-scale tagging effort using t-bar tags, some members of the Task Force also thought a more intensive sampling program in at least one Closed Area as a pilot study would be appropriate given the strong interest indicated by the fishing industry during Town Meeting discussions.

There is important cod habitat in both Area I and in the Western Gulf of Maine Closed Area (nursery habitat) that makes an intensive study compelling in either case. An advantage to selecting Closed Area I for this study is its close proximity to the Great South Channel. This could make for an interesting acoustic study to look at the relationship between an open and a closed area, both of which are perceived to be of significant value to groundfish. For example, given that conventional tagging already would be taking place in Great South Channel, this might provide a basis for comparison. An added advantage might be some economic efficiency for tag deployment. Obviously given the size of Area I (roughly 400 square nautical miles) and the high costs of acoustic technologies (receivers have to be placed roughly one mile a part if a hydrophone array is used), it would be necessary to further refine this study area. One possibility would be to deploy a fixed acoustic array along the northern boundary. This would require that an estimated 23 hydrophones (surface and bottom) be deployed. This could provide additional information about spatial and temporal movement patterns between the closed area and within the Great South Channel.

The array of hydrophones would be set up inside and outside the closed area. Several hundred large cod (80 to 110 cm) could then be tagged externally with acoustic transmitters. The transmitters would detect movement inside and outside the area. This would require regular data retrieval from the mooring buoys (e.g., monthly). In addition, it might be appropriate to have a complementary effort of tracking fish

immediately following release on board commercial vessels using a mobile directional hydrophone. If the fish remain in the area, diel behavior patterns can be documented and compared with temperature and salinity information to further assess habitat usage. Additional habitat studies using a towed video array or bottom grab samples might be possible as well or could be conducted with the help of the Industry-based Surveys.

Despite the interest in using a hydrophone array and acoustic tags to monitor closed areas, some members of the Task Force expressed reservations about the high costs and obstacles to successfully conducting such an experiment in the open ocean. They felt that acoustic tags might be worthwhile to use, but not as part of a static hydrophone array. Since monitoring the effectiveness of closed areas is clearly a fishing industry priority, program implementers should remain open to proposals, which provide further justification for using either acoustic tags or other kinds of electronic tagging devices to monitor small-scale fish movement patterns inside and outside of closed areas.

Furthermore, it should be recognized that tagging studies alone will not be able to address the industry's recruitment question. Assessments of reproductive output and larval input also are necessary.

Additional Inshore Tagging Studies

1. What are some of the finer-scale cod movements?

Other studies using acoustic and archival tags may be worth considering for inshore areas. In particular, it would be worth learning more about habitat usage and what factors drive fish movement on a finer-scale in inshore waters (e.g., are there diurnal movements related to depth contours and prey availability).

The value of using electronic tags for some of these inshore studies is that they may yield more detailed information about fish movements where there are insufficient numbers of fish for conventional tagging. For example, the Department of Fisheries and Oceans has proposed conducting limited acoustic tagging in Canadian inshore waters. It also intends to minimize project costs by utilizing equipment (a broad geographic hydrophone array) of a concurrent study being conducted on Atlantic salmon movements. The U.S. also is studying salmon movements using acoustic equipment. Perhaps, individual project proposers could explore the possibilities of utilizing the existing U.S. infrastructure for their respective cod-tagging project.

Some areas and local movement relationships identified during Town Meetings and by the Task Force as possible study sites included: movement up into Grand Manan Channel and around Digby Neck; movement between Mount Desert Rock/Seal Island (out to 40 fathom line); movement up into bay areas such as Passamaquoddy Bay, Penobscot Bay, Cobscook Bay (fish are seen in these waters almost year round); movement into the Sheepscot River; movement patterns from the Isle of Shoals to the mouth of Casco Bay; and the relationship between Seguin and Kettle bottoms and Monhegan.

Unresolved Points of Discussion

There was a looming question of whether Research Days would be counted against Days at Sea. In many areas fishermen did not want Research Days to count against Days at Sea. However, in Ellsworth where the groundfish fishery is very small, there was interest in having Research Days count so that fishermen could retain their groundfishing permit. A suggestion was made about leaving the option up to individual fishermen as to whether to count days or not. A point was raised that since in either case fish could not be kept, this may be a mute point.

Another point raised was that if fishermen are to participate in this or any other collaborative research program, they should not be penalized if their catch record is lower because they gave up fishing days to participate in research efforts, what is now commonly referred to as a "research penalty". With respect to this program, since the actual number of days is fairly low over the course of an entire year, roughly one day per month, this should not have much impact on retention of fishing permits.

The issue of whether there is a need for experimental fishing permits also was discussed during the Town Meetings. It was suggested that when collaborators are preparing their proposals for submission, they may want to secure letters of support from various interest groups (including the environmental community) if they anticipate needing experimental fishing permits to complete their work. This may help expedite the permit review process and help ensure that the research is not delayed. One industry representative even went as far as to suggest that the Task Force should recommend that a blanket experimental fishing permit be granted for the tagging program as a whole so that research could begin promptly. Since it was not possible to anticipate the scope of the work proposed by various proposal submitters, no such recommendation could be made.

An unresolved point of discussion was over the issue of whether to tag other incidentally caught species as part of this tagging effort. While there was some support for this expressed at Town Meetings and by some members of the Task Force, others on the Task Force felt that in order for tagging studies to be scientifically valid they should be tailored to individual species. For instance, flatfish generally are more vulnerable so special handling techniques may have to be employed to enhance their survival rates. However, another scientist pointed out that for species such as halibut and barn-door skate there is so little information now that any new information collected through opportunistic tagging would be beneficial.

Program Infrastructure

An infrastructure for program implementation was outlined during the second Task Force meeting and fleshed out at subsequent meetings. This infrastructure consists of: 1) a Centralized Clearinghouse for tag return data and information dispersal; 2) a Clearinghouse Steering Committee to evaluate program results and provide future direction to the Clearinghouse; 3) the Northeast Fisheries Science Center for long-term storage of data and information; and 4) local coordinators for program implementation.

Centralized Clearinghouse

Role of Clearinghouse

The impetus for the Clearinghouse is to coordinate local cod-tagging efforts and overcome existing hurdles regarding the timely release of information to the fishing community through the establishment of a regional mechanism for information exchange.

The primary role of the Clearinghouse is to provide a centralized location where tag return information could be reported and fish samples could be stored in the short term. Specifically,

- The Clearinghouse is responsible for generating a thank you letter to each fisherman who turns in a tag along with a summary report on the individual fish movement patterns. The corresponding letter and report should be distributed to the fisherman within three (3) business days or some reasonable timeframe as a means of providing an immediate reward to the fisherman for turning in the tag. In addition, the Clearinghouse is responsible for posting data on a web page on a regular basis. *During each of the Town Meetings and Task Force meeting discussions, there was genuine interest expressed by the fishing community to have access to timely information. In fact, many fishermen cited this as the primary reason for their willingness to participate in a tagging effort.*

- The Clearinghouse also is responsible for reward distribution (e.g., distribution of small incentives like hats to each fisherman and administering an annual dual lottery program). *While there clearly was support for small incentives to individual fishermen, there seemed to be much more interest in an annual reward program, where the names of both the fishermen who tagged fish and the fishermen who turned in tags would be entered into an annual drawing. There was widespread support for $1,000 being paid to the winners of the drawing. One fisherman raised the point that most of the fishermen who voiced an opinion on incentives were already eager to participate in the program. He felt that there should be a further incentive for fishermen to overcome resistance to turn in tags. He suggested paying $20 to $50 per tag to enhance return rates. A New Hampshire recreational fisherman who provided comments via email also suggested that a stipend be offered for tag returns on the order of $25 to get recreational fishermen to turn in tags.*

- In addition, the Clearinghouse maintains a catalogue of other current tagging projects and programs. If an individual called in with a tag return from one of these other efforts, they would be directed to the appropriate coordinating group. The intent would be to minimize confusion and frustration among individuals who find tags so they know where to call to report information. *A word of caution was raised by some members of the Task Force that if other tagging programs are not effectively run, the Clearinghouse and broad-scale tagging program run the risk of negative association by providing this service. Despite this concern, the feeling prevailed that providing this service was a good idea.*

While there seemed to be general agreement among Task Force members and during Town Meeting discussions that individual fishermen should have timely access to data on individual fish movements. The issue of confidentially and who gets access to data collected first (e.g., the Clearinghouse or project scientists?) was unresolved.

It was recognized that there are clear advantages to scientists who participate in this program, such as: 1) access to a wide range of regional data that may aid them in their specific research projects; 2) assistance with timely information dissemination to the fishing community regarding individual tag returns; 3) assistance with administering a comprehensive reward scheme; and 4) assistance with raising the visibility of their respective project and the potential for a higher tag return rate because they would be part of a widely publicized, broader-scale effort.

Still there was some concern among scientists about proprietary information and ensuring the integrity of their own studies. A few scientists voiced an opinion during the last Task Force meeting that local project coordinators (e.g., scientists and fishermen) should have access to the data before they are sent to the Clearinghouse. Typically results from scientific studies are distributed to the project scientists first as a matter of protocol for immediate analysis.

While the Task Force did not reach consensus on how best to address this concern, a possible solution would be to provide rough tag and catch locations to individual fishermen and the public (e.g., on the scale of Jeffreys to Georges Bank) with the exact latitude and longitude coordinates transmitted to the individual projects/researchers. Information on fish size and dates of tagging and recapture also could be withheld. As a result, the general public would have a fairly good understanding of what is going on in the region, but only the group with the detailed information would have enough information to publish. This constraint could be relaxed after a given time period (e.g., five years), at which time all the information would be made public. The other advantage of this approach is that it would help address the concern of some fishermen about data being used prematurely to influence management decisions.

If this option is not workable for scientists or acceptable because it would mean delays in making the complete data accessible to everyone, perhaps, it must be recognized that initially not all scientists will want to participate in this program. As the

Clearinghouse is established and expands to include tagging programs for additional species, others may see the advantages of combining resources, having more open exchange of data and information and accessing a long-term funding stream for tagging studies.

Clearinghouse Staffing

The staff can be relatively small. But, at minimum, should include a database manager (someone who is capable of establishing and maintaining the database) and an outreach person to coordinate with local groups who are administering the various projects. The outreach person also will oversee distribution of small-scale incentives, administer the annual lottery and work in conjunction with the database manager to distribute thank you letters and individual fish movement reports to fishermen.

Clearinghouse Funding

The Clearinghouse should remain in operation beyond the duration of the actual tagging effort. This will ensure that the majority of tag returns have been received, information is disseminated in a timely manner and some initial analysis is completed. Since a recommendation was made that the tagging program itself span a minimum of two years, it is anticipated that the Clearinghouse will be in existence a minimum of five years. Furthermore, if this cod-tagging program is successful then the Clearinghouse mandate should be expanded to include other tagging efforts on additional species in the future. There also may be some incentive for other non-federally funded projects to share their data with the Clearinghouse if they believe they will get a higher return rate for their respective projects. The key will be for the Clearinghouse to generate enough publicity and support from the fishing industry to ensure a high tag return rate for this program as a means of attracting other projects. With greater participation from a variety of independent efforts the database could be expanded thereby creating a more regionwide picture of species movements. If this were the case, the lifespan of the Clearinghouse would be expected to extend well beyond a five-year timeframe.

To this end, the Clearinghouse should be funded on hard money. Additional thoughts on funding include: a small portion of funding could be derived from the private foundation community currently funding collaborative research initiatives and, eventually as the database is expanded, various user groups could be asked to pay some sort of user fee.

With respect to funding for field work (actual fish tagging), it was thought that since the operating expenses for continuing fieldwork are relatively small, compared to set-up costs, perhaps the industry could absorb some of the future costs if they deemed the program to be worthwhile.

Clearinghouse Selection Criteria

Members of the Task Force concurred that organizations interested in serving as the Clearinghouse for this program should submit a proposal under the RFP process. *The Task Force did not feel that it was appropriate to make a recommendation about which would be the most appropriate organization to serve in this capacity. However, it did agree that there are a number of reputable organizations including, but not limited to, University of Massachusetts/SMAST, Manomet Center for Conservation Sciences, the Gulf of Maine Aquarium, the Island Institute and the University of New Hampshire which may be individually qualified or may seek to collaborate in such an effort.*

To aid in this selection process, the Task Force developed the following set of Criteria for Clearinghouse Selection:

I. Must be identifiable as an independent entity specific to this cod-tagging program, at least initially. The organization's role may be expanded in the future to incorporate other specie's tagging efforts depending on its initial success with the cod-tagging program.

   A. If the Clearinghouse was established as a separate entity but still could take advantage of some of the existing infrastructure of an established organization such as SMAST, UNH, Manomet, or Island Institute, etc., this may maximize available federal monies.

II. Should be a neutral third party with the ability to house, manage and conduct some of the analysis of the data.

   A. Tags should not identify specific group but rather simply read, "Regional Cooperative Cod Tagging Program" with corresponding return phone number and U.S. and Canadian return addresses.

   B. Tags should include a 1-800 phone number where U.S. and Canadian fishermen can call to report information.

   C. Tags should be coded with individual project numbers for timely reporting of information to the respective research scientist.

III. Must serve as coordinator, as research methodologies may vary by area and/or gear type, to maximize the dispersal and return of tags.

IV. Should have access to community-based groups to build support for the program and disseminate program results (e.g., fishing cooperatives, Northwest Atlantic Marine Alliance (NAMA), Massachusetts Fishermen's Partnership/Gloucester Fishermen's Wives Association, Bay of Fundy Marine Resources Center, and Center for Community-Based Management, etc.).

V. Must have the capability to make the data readily accessible to all interested parties in a timely manner. Should have the technical expertise to develop a web page and the ability to establish links with existing mechanisms for data dissemination.

   A. Need to have a plan in place for how the data will be distributed.

VI. Should have capability to mount historic data and make these data compatible with data collected throughout this program.

VII. Should have adequate storage space for samples (freezer) and some analytical capabilities.

VIII. Should have the ability to coordinate International efforts or collaborate with Canadian counterparts, given that tag dispersal and returns likely will occur in Canadian waters as well.

Clearinghouse Steering Committee

This would be an overarching body consisting of scientists and fishermen to periodically review the data collected throughout the overall cod-tagging program (e.g., on a bi-annual or annual basis) and to evaluate program success to date. Clearly there are concerns among members of the fishing community and scientific community about data bias and the use of inadequate data for management decisions.

This body would examine the results of the tagging program, identify data gaps and make recommendations for additional tagging studies. It would provide another level of evaluation along with the SARC and the NEFMC Research Steering Committee and provide fishermen with a more active role in tagging program design and evaluation. It also would provide guidance on enhancing data dissemination and operating goals for the Clearinghouse – specifically how, when and where the Clearinghouse should manage the data.

Furthermore, the Steering Committee would continue to build trust by maintaining an ongoing working relationship between fishermen and scientists in project design and evaluation. It would consist of various groups currently involved in tagging programs including: state agencies; provincial agencies; federal scientific agencies; academic institutions; and fishing organizations. The Steering Committee should have a fixed chair and rotating member seats.

There was considerable discussion during the third and fourth Task Force meetings and during the Chatham Town Meeting about the need for quality control of data collection and data usage. While initially the thought was that this Steering Committee would only be responsible for examining the role of the Clearinghouse and how data could be more effectively distributed, during subsequent discussions the role of this body evolved into

a much broader mandate as outlined above. It was recognized that such a body could provide technical advice to the NEFMC Research Steering Committee and federal and state management agencies on this and future tagging efforts.

It also was recognized that there is a clear need for long-term monitoring, particularly when and if this program ends. Perhaps if this body were established as a formal mechanism with a mission to look at the "snap-shot" of existing conditions generated by this program it might be able to provide some guidance about future spin-off tagging projects or programs that should be implemented to help understand the dynamic nature of this productive marine ecosystem.

Northeast Fisheries Science Center Role

There was fairly widespread agreement that collected data also should be shared with the Northeast Fisheries Science Center for long-term storage and further analysis. An overarching goal of this program is to collect scientifically credible data and information about cod distribution and movement patterns to complement existing data collection efforts such as the semi-annual government trawl surveys.

In addition, since the Clearinghouse is designed as a small-scale operation, it may be necessary given the volume of data that likely is to be generated to have an established facility with ample storage space to warehouse both data and fish samples.

Furthermore, in the event that long-term funding for the Centralized Clearinghouse is unavailable, this will ensure that data collected through this effort will be preserved and remain accessible to the public.

Local Coordinators

It is expected that fishermen working in concert with academic scientists and/or state scientists experienced in tagging efforts will submit proposals through an RFP process administered by the NMFS and NEFMC Research Steering Committee to implement specific projects under the umbrella of an overall cod-tagging program. This will provide a coordinated approach for funding allocation.

The Task Force recommends that each of these individual project proposals include local coordinators who will build support for the program, maximize distribution of the tags and provide another point of contact for tag returns or collection of biological samples for scientific purposes. Local coordinators could be a fisherman, a fishing cooperative, fishing organizations, non-profits, a state agency or a research entity. When the Canadian program is established there also should be similar points of contact in Canada involving Canadian NGOs and fishing organizations.

Some of the responsibilities of these local coordinators include: conducting local outreach and publicity for the program, identifying fishing vessels, paying vessels for

their time, administering training, ordering and disseminating supplies, collecting biological samples and maintaining contact with the Clearinghouse (could collect tag return information and forward it to the Clearinghouse or merely direct tag returns to the Clearinghouse).

While generally it is recognized that a variety of groups likely will implement various aspects of this program, in order to ensure consistency in tag deployment and collection efforts, all local coordinators must participate in a one-day training program and be "certified" as trainers.

Outreach

A great deal of emphasis was placed on the need to generate adequate public awareness about the benefits of the tagging program and to regularly publish program results in an effort to increase participation. A suggestion was made that a local advertising agency be contracted to develop a promotional campaign for the program pro-bono. It also was suggested that the NMFS and NEFMC should utilize existing mechanisms to build support for the program (e.g., regional press office, various publications, web page, regular industry mailings, etc.) However, given the concern that some fishermen may be unwilling to participate in this effort unless data are sent to a neutral entity, it may be necessary for government agencies to maintain a low profile with respect to this program. An alternative may be to make sure that all publicity generated surrounding the program (e.g., press releases) come from both fishing industry and government agencies. This also will help strengthen the public perception that this is indeed a "collaborative effort."

It was recognized that there is a need for a two-phased public awareness program – 1) Building initial support for the program to ensure the broadest possible participation; and 2) Enhancing tag returns through targeted efforts towards fishermen (commercial and recreational) and the scientific community. Both phases of Outreach are equally important to the success of the program.

Phase I: Building Public Support

Outreach efforts should include everyone from multispecies permit holders to recreational fishermen. Some specific outreach efforts include but are not limited to:

- Strategic placement of articles announcing the start of the program -- its purpose and goals -- to appear in commercial fishing industry trade journals, newspapers and industry association newsletters; recreational fishing industry magazines; and local and regional newspapers. Also articles should be placed in corresponding New Brunswick and Nova Scotia publications.

- Bilingual promotional flyers to be prepared and distributed to all fishing industry coperatives, fishing organizations and charter boat operators prior to the start of the fishing season for distribution to their members.

- Radio and televisions interviews to be conducted in strategic markets to pitch the program to a wider audience and reach recreational fishing and boating communities.

Phase II: Outreach to Enhance Tag Returns

- Weekly reminders to turn in tags to be aired on the weather channels (weather box).

- Regular advertisements and articles (progress reports) about the importance of turning in tags and where to turn them in should appear in trade publications, recreational fishing magazines and journals and local and regional papers. In addition, advertisements also should appear in corresponding publications in New Brunswick and Southern Nova Scotia.

    - For instance, there should be monthly reminders in Commercial Fisheries News throughout the duration of the program to encourage people to turn in tags as well as periodic articles to discuss the goals of the program and progress to date.

- All weather bilingual posters should be located at all major fish landing and processing facilities and recreational docks providing details of the program and where to turn in tags.

- A concerted effort should be made to encourage the charter boat operators to return tags, particularly those returned from offshore areas (e.g., presentations made at industry meetings, announcements made in industry publications, mailings distributed, etc.).

- Bilingual flyers should be distributed on docks and in areas frequented by recreational fishers and charter boat operators.

- Quarterly or semi-annual reports/newsletter on how the projects are going, to be distributed to all individuals who turn in a tag.

- In addition, the NMFS should distribute information packages including an announcement flyer and return envelopes to all permit holders to encourage tag returns. The goal will be to make them aware of the program, encourage a higher number of tag returns and identify future program participants. Specific information should be included about where tags should be sent, what data are needed in association with the returned tag, along with envelopes to place the tags in when they are found. Should fishermen decide that they would rather call in from their vessel to report the tag return first before mailing in a tag, they also should be provided with a 1-800 number for reporting information. State and Canadian government agencies also should distribute information about the tagging program through their regular industry mailings.

- A Web page should be established to post program results.

Budget

Primary Study: Regional Cod Tagging Program

An estimated 80 fishermen will deploy 100 tags per day for 7 days per year on dedicated trips
Program Duration: 5 Years

Expense	Option #1	Option #2	Option #3
	(Tagging over 1 yr) 25,000 Tags Deployed	*(Tagging over 1 yr) 50,000 Tags Deployed*	*(Tagging over 2 yrs) 100,000 Tags Deployed*
Equipment			
T-bar tags (floy spaghetti @55 cents each) 20 percent assumed for replacement tags	30,000 x .55	60,000 x .55	120,000 x .55
Cost	$16,500	$33,000	$66,000
T-bar guns/scissor grip fish taggers (120/150 @ $75 each)*			
Cost	$9,000	$9,000	$11,250
Replacement Needle for tagger (240/300 @ $8.50 each)*			
Cost	$2,040	$2,040	$2,550
Tackle Boxes/ Walmart or Internet (100/120 @ $10 each)*			
Cost	$1,000	$1,000	$1,200
Holding Tanks /150 circular 100 gallon 3 ft tall, 4 ft wide, black durable plastic (100/120 @ $40 each)*			
Cost	$4,000	$4,000	$4,800
Measuring Boards /rulers for fishermen to meld to plywood (240/300 @ $10 each)*			
Cost	$2,400	$2,400	$3,000
Thermometers /hand-held plastic sheath for sea surface temperature (240/300 @ $10 each)*			
Cost	$2,400	$2,400	$3,000
Data sheets /200 sheets waterproof paper (200 @ $20 per box, including printing costs)			
Cost	$1,600	$1,600	$3,200
Self-addressed envelopes /7 10x13" per participant per trip/printing,postage,handling (1000 to 2,000 2-color $356)			
Cost	$356	$356	$712
Vessel Time (80 for 10 days @ $1500 per day)**			
Cost	$600,000	$1,200,000	$2,400,000
Extra Survival suit for Trainer/Local Coordinator (20 Trainers @ $400 each)			
Cost	$8,000	$8,000	$16,000
Equipment Cost	**$647,296**	**$1,263,796**	**$2,511,712**
Personnel			
Project Management/Data Analysis salary including fringe (10 sites @ $20,000 per site)			
Cost	$200,000	$200,000	$400,000
Local Coordinator (20/10 sites @ $5,000 each)			
Cost	$100,000	$100,000	$200,000
Personnel Cost	**$300,000**	**$300,000**	**$600,000**
Local Outreach and Training			
Travel/Proj Personnel (20/10 sites @ $2,000 each) training, data collection, meetings, site visits			
Cost	$40,000	$40,000	$80,000
Local Ads/Mailings (10 sites @ $3,000 each)			
Cost	$30,000	$30,000	$60,000
Local Outreach and Training Cost	**$70,000**	**$70,000**	**$140,000**
PROGRAM SUBTOTAL	*$1,017,296*	*$1,633,796*	*$3,251,712*

Clearinghouse	**Option #1**	**Option #2**	**Option #3**
Personnel			
Outreach Person			
5 years @ $35,000 per year + 25% fringe)			
Cost	$218,750	218,750	$218,750
Database Manager			
5 years @ $30,000 per year + 25% fringe)			
Cost	$187,500	$187,500	$187,500
Personnel (cont'd)			
Consultants (technician, data analysis)			
Cost	$15,000	$15,000	$15,000
Personnel Cost	**$421,250**	**$421,250**	**$421,250**
Outreach Activities			
Informational/Training Seminar for Local Coordinators/PIs			
facility rental, food, travel/per diem/30 people			
Cost	$30,000	$30,000	$60,000
Advertising (bilingual posters, ads, flyers)			
(outreach to include Canadian publications)			
Cost	$30,000	$30,000	$60,000
Incentives/Lottery Program			
(hats @ 5.00 each or $20 per tag/10% return rate)***			
Cost	$12,500 - $50,000	$25,000- $100,000	$50,000- $200,000
(Annual lottery, $1000 per year, 5 years)			
Cost	$5,000	$5,000	$5,000
Info Packages (Program flyer, tag return envelopes) includes printing & postage, distributed to all federal permit holders (6,000 @ $5.00 each)			
Cost	$30,000	$30,000	$60,000
Training Video			
production, duplication & distribution			
Cost	$20,000	$20,000	$22,000
Training Brochure			
production & distribution (3000 copies)			
Cost	$20,000	$20,000	$20,000
Travel (outreach person/database mgr.-- 5 yrs.) (meet with local coordinators, consultants, conduct meetings, etc.)			
Cost	$30,000	$30,000	$45,000
Outreach Activities Cost	**$165,000**	**$165,000**	**$272,000**
Operations			
Copier Machine			
60 months @ $120/month at a Sharp gov't rate			
Cost	$7,200	$7,200	$7,200
Copier Service			
.0232/page estimating 10,000 copies per year for 5 years (assumes gov't rate)			
Cost	$1,160	$1,160	$1,160
Paper			
10 cases @ $32 (5,000 sheets) per case			
Cost	$320	$320	$320
*FAX***			
Fax and phone supplies (includes 1-800 number)			
Cost	$4,000	$4,000	$4,000
*Phone****			
two phones including installation			
Cost	$1,000	$1,000	$1,000
Computers			
(2 @ $1,500 each plus accessories)			
Cost	$3,000	$3,000	$3,000
Software			
upgrades, database			
Cost	$3,000	$3,000	$3,000
*Printers****			
1 w/supplies, ink cartridges			
Cost	$1,500	$1,500	$1,500
*High Speed Internet Access Charges****			
Est for 5 years/breakdown varies by area			
Cost	$4,000	$4,000	$4,000

(Operations Cont'd)	**Option #1**	**Option #2**	**Option #3**
Office Supplies pens, staplers, envelopes, etc.			
Cost	$5,000	$5,000	$5,000
Office Furniture desks, chairs, file cabinets			
Cost	$7,000	$7,000	$7,000
*Office Space Rental***** (60 months rent @ $1,000 per month for 1,000 square feet)			
Cost	$60,000	$60,000	$60,000
*Electricity***** $200 per month			
Cost	$12,000	$12,000	$12,000
Operations Cost	**$127,180**	**$127,180**	**$127,180**
CLEARINGHOUSE SUBTOTAL	*$725,930*	*$738,430*	*$870,430*
TOTAL	**$1,743,226**	**$2,372,226**	**$4,122,142**

* Quantity reflects amount needed for one year vs. two year program
If concerned about consistency in measurements for returns, should use same equipment for measuring fish as used by taggers.
Should distribute measuring boards to, at minimum, all federal permit holders (6,000). Costs would increase accordingly per line item to:
Opts 1 & 2: $120,000 (assumes each fisherman gets 2 measuring boards); Opt 3: $150,000 (assumes 25% increase over 1 yr program)

**Includes three extra days to account for weather or inability to locate fish

***If you were to offer $20 per tag as an incentive for returning tags rather than a hat, cost per bottom line for each option would increase $1,780,726; $2,447,226; $4,272,142 respectively

****Some of these costs may be unnecessary if utilize existing infrastructure of an established organization

Add an additional $13,750 to each bottom line if intend to cover cost of supplying tags to Canada

Institutional overhead costs are not included

Secondary Projects Fine-scale movements (Closed Area and Additional Inshore Tagging Studies)

Numerous scale projects could be completed using electronic tags, this budget provides for a variety of options

Data Storage Tag Expenses (possible to fund 2-3 small-scale projects)			
	Temperature tags	5,000 @ lasting 5-7 years @ $10 each	$50,000.00
	Temp. and Pressure tags	1000 lasting 3 years @ $300 each	$50,000.00
	Data Readers	Usually inclusive	$50,000.00
	Software	usually inclusive	$500.00
	Fishing Vessel Compensation	5 vessels, 15 days @ $1500 per day	$337,500.00
	Personnel (scientists, students, fishermen)	3 months, assumes matching monies will cover some of these expenses for training, tagging, data analysis	$80,000.00
Total Cost			**$568,100.00**
Acoustic Tag Expenses (includes expenses for Closed Area I Pilot & extra tags for one inshore study)*			
	Acoustic tags	2000, 6 month battery life at $250 each	$500,000.00
	Hydrophones	23 - 2 at each point, 1 surface/1 sunk, to about 1 mile apart @ 3,500 each	$161,000.00
	System	can handle 23 hydrophones	$52,910.00
	Program	to work up data	$2,000.00
	Software	to analyze data	$2,000.00
	Hardware (computer)	must be a dedicated computer	$2,000.00
	Mooring buoys	23 - 8 inflatable, 8 submerged @ $300 each (to be verified)	$6,000.00
	Fishing Vessel Compensation	5 days @ 1,500 per day/may need to use gov't vessel	$7,500.00
	Personnel (scientists, students)	$15,000 for 2 months (including fringe) for project design/analysis	$10,000
	Mooring hardware	anchor, chain, collars, swivels	$3,900
Total Cost			**$747,310**

* Assumes that the inshore study will be able to utilize salmon static hydrophone array

May be most appropriate to allocate a sum of money for testing electronic tags in inshore and closed areas and allow project proposers flexibility in project design

Overhead Costs are not reflected in this budget as they will vary with individual project proposers

Both budgets constitute ballpark estimates. Final budgets will be contingent on project specifics

Ancillary Projects

(Institutional Overhead costs are not reflected in any of these estimates.
All budgets represent ballpark estimates and must be refined based on project specifics.)

Age and Growth Study
Sample Size: 1,000
Assuming 100 fish samples from 10 sites
Assuming 10 fishermen on dedicated trips

Procedure: Otolith Baking		**Cost**	
Otolith Collecting			
Knives	20 (two for each fisherman) @ $20.00 each	$	400.00
Forceps	20 (two for each fisherman) @ $8.00 each	$	160.00
Envelopes for otoliths	1,000 2x4 envelopes @ $50/500	$	100.00
Measuring Board	10 rulers for mounting onto plywood @$10.00 each	$	100.00
Scale	10 digital hanging scales @ $100.00 each	$	1,000.00
Thermometer	20 (2 for each fisherman) @ $10.00 each	$	100.00
Datasheets	1,000 sheets (100 sheets/fisherman) @ $20/box of 200	$	100.00
Envelopes for datasheets	1,000 10x13 self-addressed envelopes	$	300.00
Postage	1,000 at .55 per envelope	$	550.00
Fishing Vessel	10 trips at $1,500 per trip	$	15,000.00
Otolith Baking Supplies			
Baking Oven	1 oven	$	1,800.00
Dissecting Scope	2 @ $2,500	$	5,000.00
Personnel			
Technician	Create manual, receive and prepare samples	$	2,000.00
Post Doctorate	Data analysis and documention of results	$	5,000.00
Outreach			
Travel	3 Training sessions for fishermen	$	1,500.00
Otolith removal manual	Publication costs	$	1,500.00
Total Cost		**$**	**34,610.00**

Maturity Stage Analysis
Sample size: 1,000
(100 fish taken from 10 sites)

Procedure: Gonad Analysis		**Cost**	
Collecting Fish			
Durable Plastic Tubs	10 tubs @ $35 each	$	350.00
Thermal covers	10 @ $35 each	$	350.00
Fishing vessel	20 trips @ $1,500 each	$	30,000.00
Fish Transportation			
Mileage	1,000 miles @ .34/mile	$	340.00
Work-up			
Scale	2 auto-calibrated scales @ $300	$	600.00
Measuring Board	2 measuring boards at $85 each	$	170.00
Scalpel	10 @ $7.00 each plus extra blades @ $17/100	$	90.00
Jars	1,000 @ $1.50 each	$	1,500.00
Datasheets	1,000 sheets @ 200/box @ $20/box	$	100.00
Personnel			
Lab technician	Fish pickups, gonad extraction and data recording	$	2,000.00
Post Doctorate	Data analysis and documentation of results	$	5,000.00
Total Cost		**$**	**40,500.00**

Procedure II: Holding Pens **Sample Size: 200 fish** **Two Vessels @ 100 fish each**		**Cost**	
Collecting Fish			
Holding tanks	2 100 gallon, 3 ft. x 4 ft. durable plastic @ $40 each	$	80.00
Drop-in chiller	2 titanium chillers @ $1,000 each	$	2,000.00
Fishing vessel	4 trips at $1,500/trip	$	6,000.00
Fish Transportation			
Truck w/holding tank	Rental @ $200/day for four days	$	800.00
Tagging			
Floy Tags	400 tags @ .55 each	$	220.00
Tagging Gun	2 @ $75 each	$	150.00
Replacement Needles	4 @ 8.50 each	$	34.00
Elastomer marks	Silicone-based dye	$	100.00
Anaestetics	Metomidate, clove oil and ethanol, or seltzer water	$	100.00
Hypodermic Needles	200 needles @ $10/box of 100	$	20.00
Scale	2 digital scales @ $100 each	$	200.00
Measuring Board	2 rulers for mounting onto plywood @ $10 each	$	20.00
Datasheets	1 box of 200	$	20.00
Facilities			
Net pen	10 ft. x 10 ft. x 10 ft. pen	$	3,500.00
Swim tube	2 steel tanks (7 ft. inserted in a 12 ft. diameter tank)	$	684.00
Tank liners	PVC liner for the outer 12 ft. diameter tank only	$	334.00
Filtration	Filter, cartridges, etc.	$	600.00
Pump	Pump, hose, and plumbing	$	700.00
Chiller	Drop-in titanium chiller	$	1,000.00
Feed	500 pounds of herring @ 1.20/pound	$	600.00
Power	Electricity, extension cords	$	500.00
Space	Rental of 1,000 sq. ft. @ $1,000/mo. For 3 months	$	3,000.00
Personnel			
Lab technician	Create manual, fish pickups, facility maintenance	$	2,000.00
Post Doctorate	Data analysis and documentation of results	$	5,000.00
Outreach			
Manual	Production/distribution to fishermen on keeping live fish	$	500.00
Travel	Mileage for fish pickups and training fishermen	$	500.00
Total Cost		**$**	**28,662.00**

Genetic Studies
Sample Size: 1,000 samples from 10 sites in spawning areas
Duration: Three years

Procedure: Larval and one year class Reference Sampling (creates the necessary baseline of which you can later compare fin clippings)		**Cost**	**Cost**
Collecting Larvae			
Plankton net	5 nets @ $1,000 each	$ 5,000.00	$ 5,000.00
Vessel time	10 trips/year for 3 years @ $1,500 per trip	$ 45,000.00	$ 45,000.00
Jars	3,000 @ $1.50 each	$ 4,500.00	$ 4,500.00
Alcohol	1,500 bottles of alcohol @ .50 each	$ 750.00	$ 750.00
DNA Supplies			
Columns	Reagents and puragene columns to isolate DNA	$ 4,000.00	$ 4,000.00
Enzymes	To amplify DNA (Taq DNA polymerase and agarose)	$ 7,500.00	$ 7,500.00
Gel Constituents	Polyacyrlamide and glass plates to set DNA	$ 1,800.00	$ 1,800.00
Buffer Constituents	To prepare gels	$ 1,500.00	$ 1,500.00
DNA Stains	Dyes to read gels	$ 1,000.00	$ 1,000.00
Films	Polarid and X-ray film to read gels	$ 3,000.00	$ 3,000.00
Pipets	Disposable, serological, and mircrocentrifuge tubes	$ 3,500.00	$ 3,500.00
PCR	Hardware and software to run gel bands	$ 5,000.00	$ 5,000.00
**Automated Sequencer	To analyze gels		$ 120,000.00
**Chamber	To analyze gels	$ 12,000.00	
Personnel			
Technician	Isolate DNA & analyze results @ $35K/yr. for 3 yrs.	$ 105,000.00	$ 105,000.00
Interns	Isolate DNA @ 3K/yr. For 3 yrs.	$ 9,000.00	$ 9,000.00
Supervisor	Analyze results/document findings @ 10% of 45K for 3 yrs	$ 13,500.00	$ 13,500.00
Fringe	30% of Technician and Supervisor salaries	$ 35,550.00	$ 35,550.00
****Total Cost Range**		**$257,600.00 -**	**$ 365,600.00**

*It should be assumed that the facility taking on this project already houses some key pieces of equipment such as thermal cyclers, microcentrifuges, and gel dryers.
This buget assumes equipment will be purchased. Costs can be substantially reduced if equipment is rented. For example, an automated sequencer could be rented for <$1 a sample, costing <$1,000 rather than $120,000, thereby reducing the overall costs from $365,600 to $246,600.

**Researchers have a choice between using a chamber or automated sequencer in analysis

Tag Shedding Studies Sample Size Assuming 80 Fishermen tagging:	Option 1 25,000 (10%=2,500) 313 fish over three trips		Option 2 50,000 (10%=5,000) 625 fish over six trips	
Procedure I: Double Tagging	**25,000 (10%=2,500)**	**Cost**	**50,000 (10%=5,000)**	**Cost**
Tagging				
Floy Tags	50,000 (double tagging) @ .55 each	$ 27,500.00	100,000	$ 55,000.00
Scales	80 @ $100 each	$ 8,000.00		$ 8,000.00
Datasheets	8,000 sheets @ $20/box of 200	$ 800.00	17,000 sheets	$ 1,700.00
Envelopes for datasheets	1,000 10x13 self-addressed envelopes	$ 300.00		$ 300.00
Postage	1,000 at .55 per envelope	$ 550.00		$ 550.00
Personnel				
Project Coordinator	Create manual on double tagging	$ 1,000.00		$ 1,000.00
Post Doctorate	Data analysis and documentation of results	$ 5,000.00		$ 5,000.00
Outreach				
Manual on Double Tagging	Production and Distribution	$ 3,000.00		$ 3,000.00
Travel	5 training sessions for fishermen	$ 2,000.00		$ 2,000.00
Total Cost		**$ 48,150.00**		**$ 76,550.00**

(Double Tagging Continued)	Option 3 100,000 (10%=10,000) 1,250 fish over 10 trips	
	100,000 (10%=10,000)	**Cost**
Tagging		
Floy Tags	200,000	$ 110,000.00
Scales		$ 8,000.00
Datasheets	33,400 sheets	$ 3,340.00
Envelopes for datasheets		$ 300.00
Postage		$ 550.00
Personnel		
Project Coordinator		$ 1,000.00
Post Doctorate		$ 5,000.00
Outreach		
Manual on Double Tagging		$ 3,000.00
Travel		$ 2,000.00
Total Cost		**$ 133,190.00**

Figures

Figure 1: Movement and Key Areas for Cod

Fishing Industry, 2001

* *Fish begin moving north up through the Great South Channel in May*

Adult cod also occur in Cobscook and Passamaquoddy Bays in winter months

Figure 2: Historic Spawning Grounds

Bigelow and Shroeder, 1953

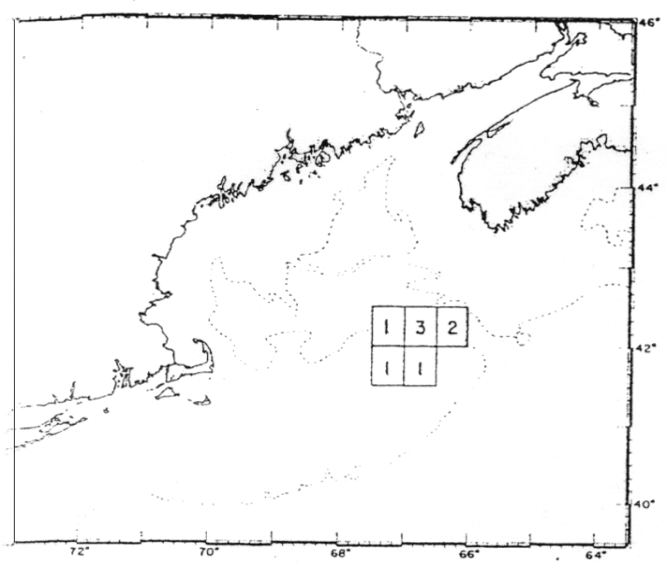
Minor Spawning Grounds

Major Spawning Grounds

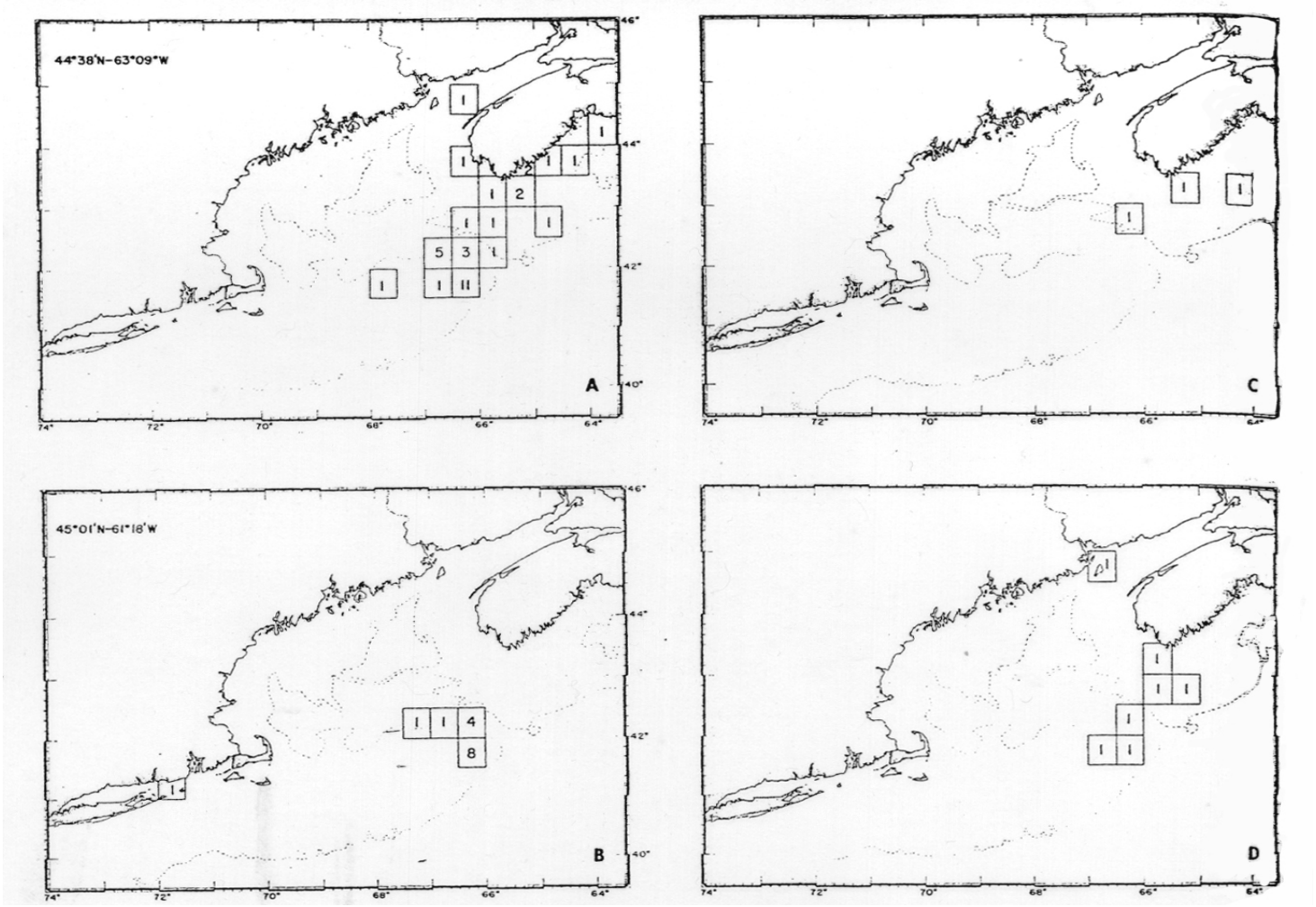
Spawning also occurs in Cobscook and Passamaquoddy Bays in Feb-May

Figure 3: Tagging Results

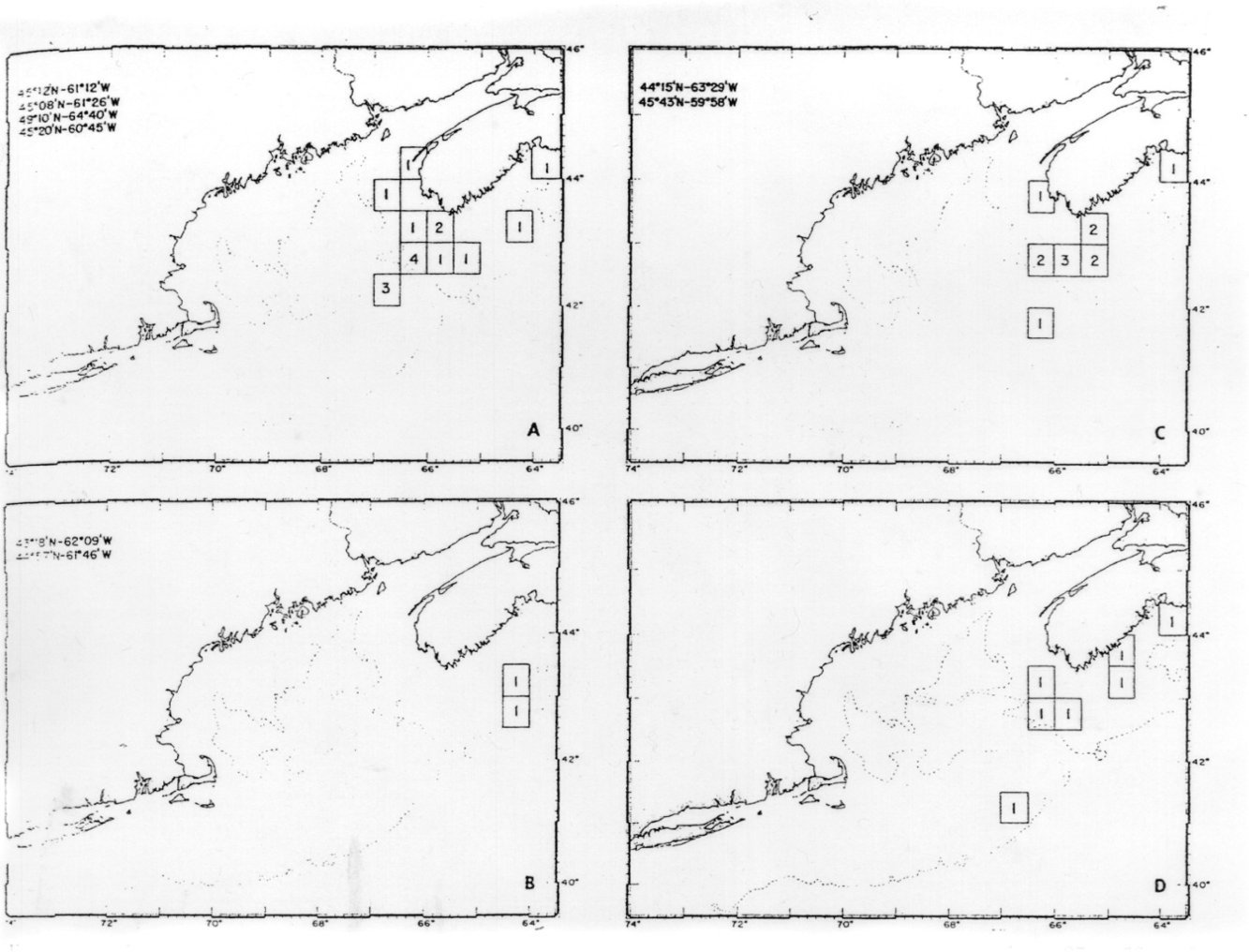
-Wise, 1963



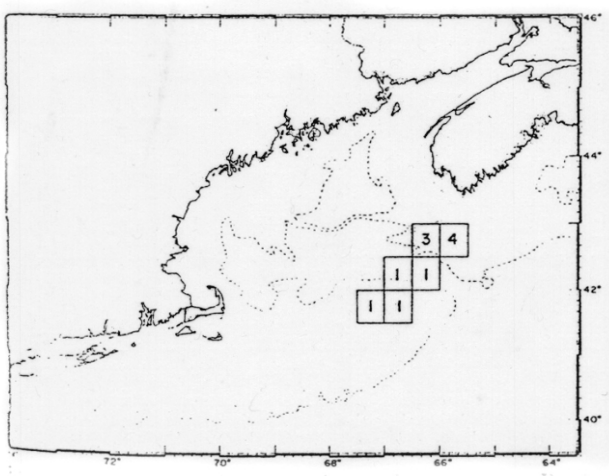
Returns from tagging cod on Georges Bank, December 1956.



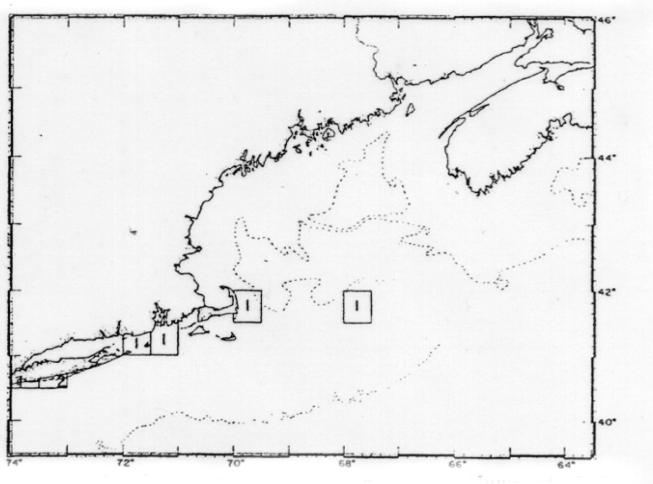
Returns from tagging cod on Georges Bank, March-April 1957.
(a) Within 26 weeks, (b) from 27 to 52 weeks, (c) from 53 to 78 weeks, (d) from 79 to 116 weeks.



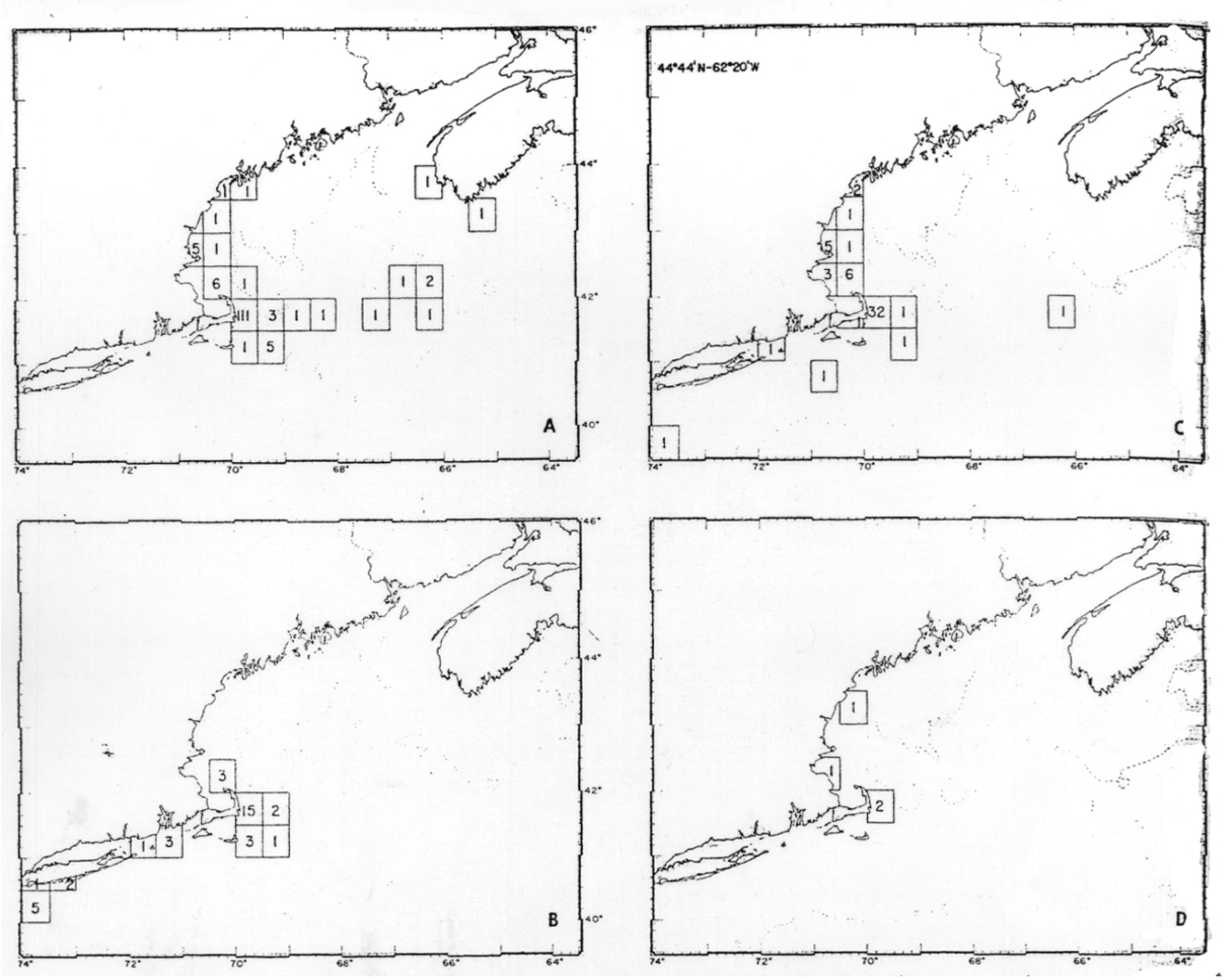
Returns from tagging cod on Browns Bank, March 1957. (a) Within 26 weeks, (b) from 27 to 52 weeks (c) from 53 to 78 weeks, (d) from 79 to 163 weeks.



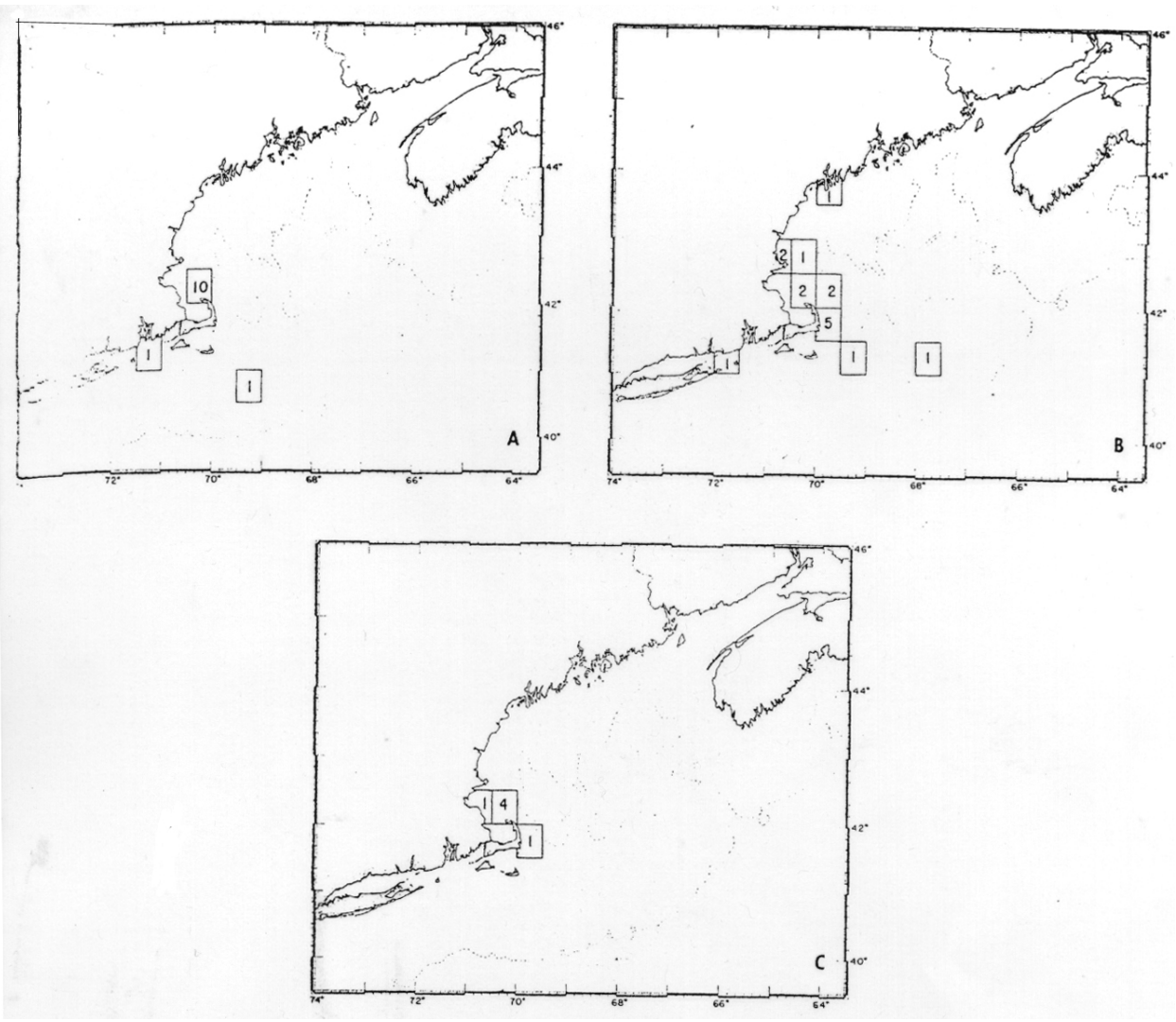
Returns from tagging cod on Browns Bank, October 1957.



Returns from tagging cod at Newport, R.I., December 1955.



Returns from tagging cod off Chatham, Mass., February-March 1957. (a) Within 26 weeks, (b) from 27 to 52 weeks, (c) from 53 to 78 weeks, (d) from 79 to 119 weeks.

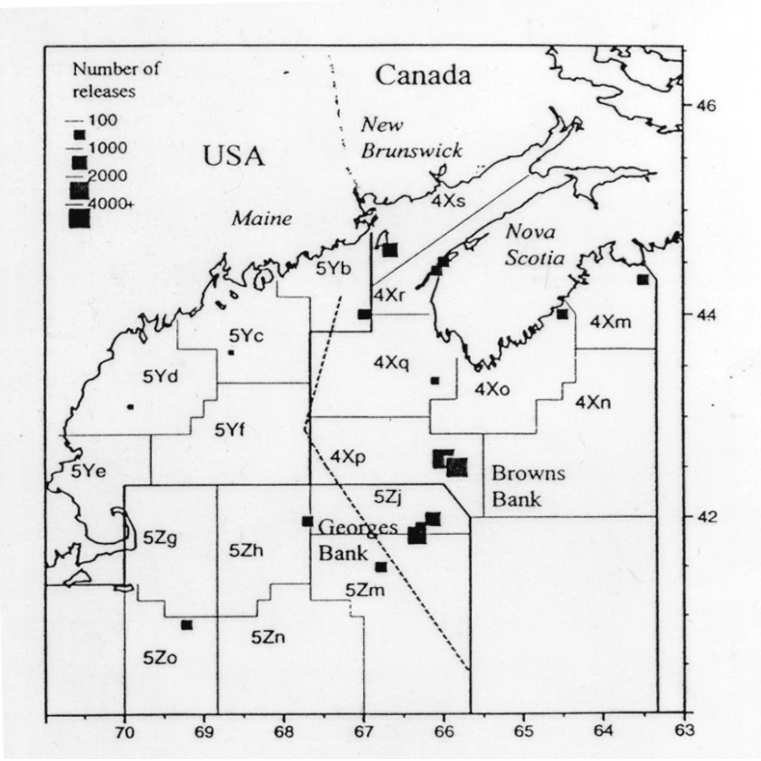


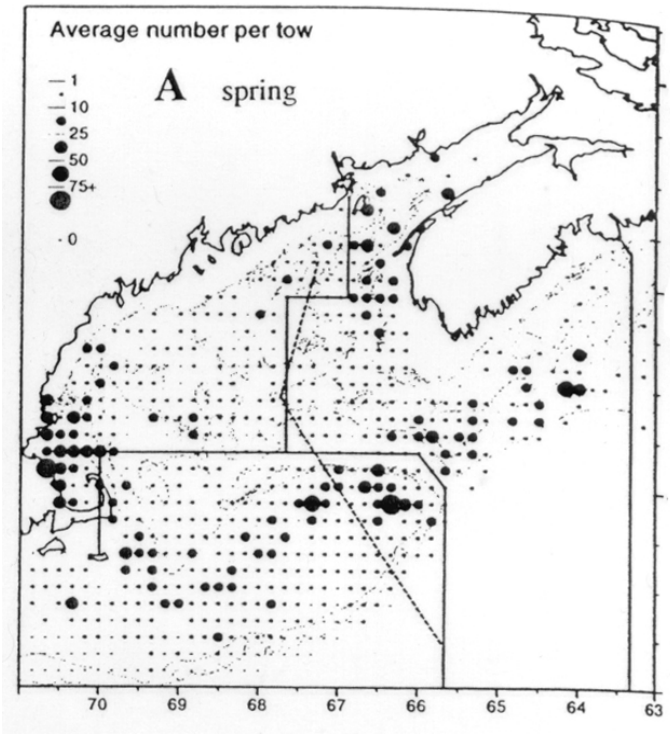
Returns from tagging cod in the South Channel and on the Highland Ground, October 1957. (a) Within 26 weeks, (b) from 27 to 52 weeks, (c) from 53 to 144 weeks.

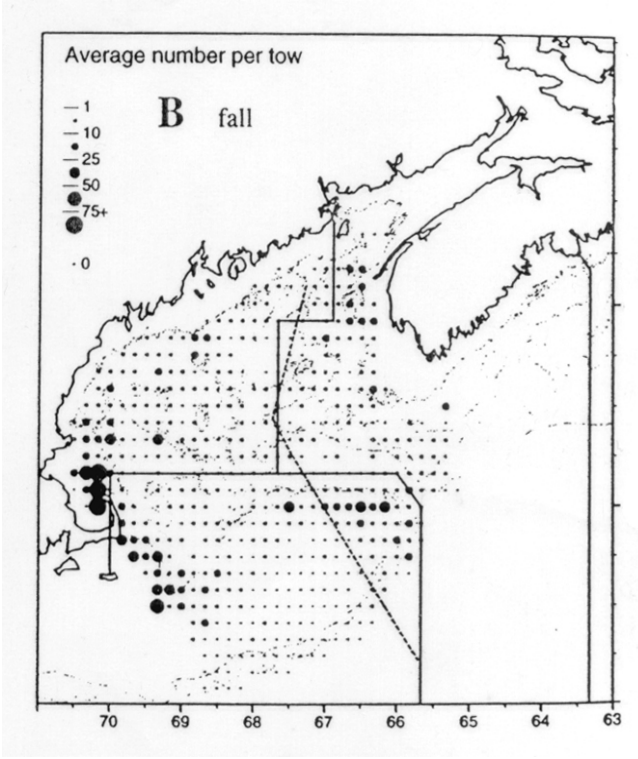
Figure 4: Tagging Results

-Hunt, et al., 1998

North Atlantic Fisheries Organization (NAFO) division (4X, 5Y, 5Z) and unit areas (eg. 5Zj) boundaries in the Gulf of Maine area and cod tag release locations.

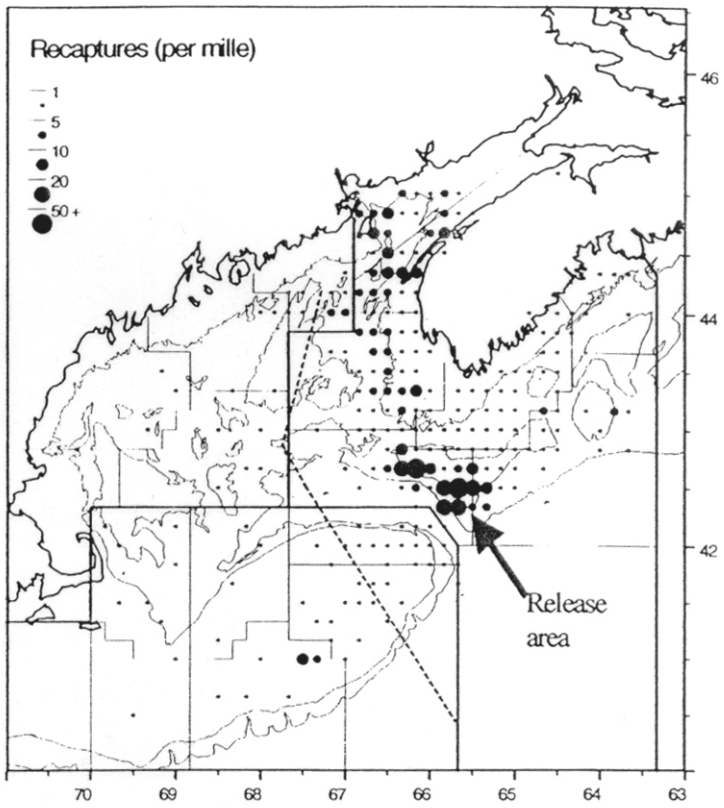




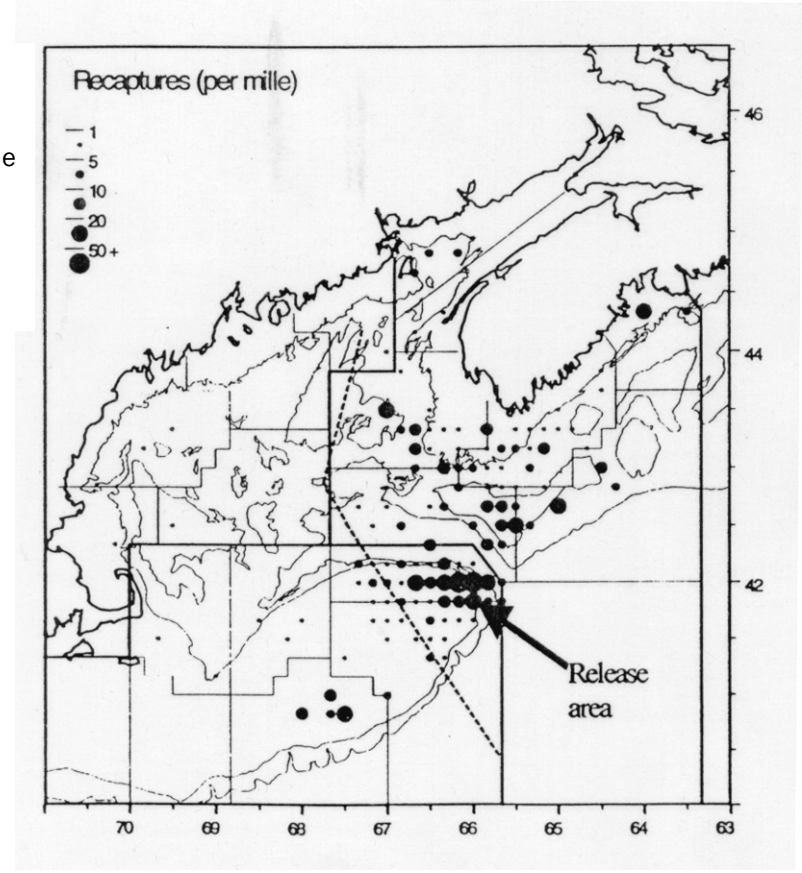


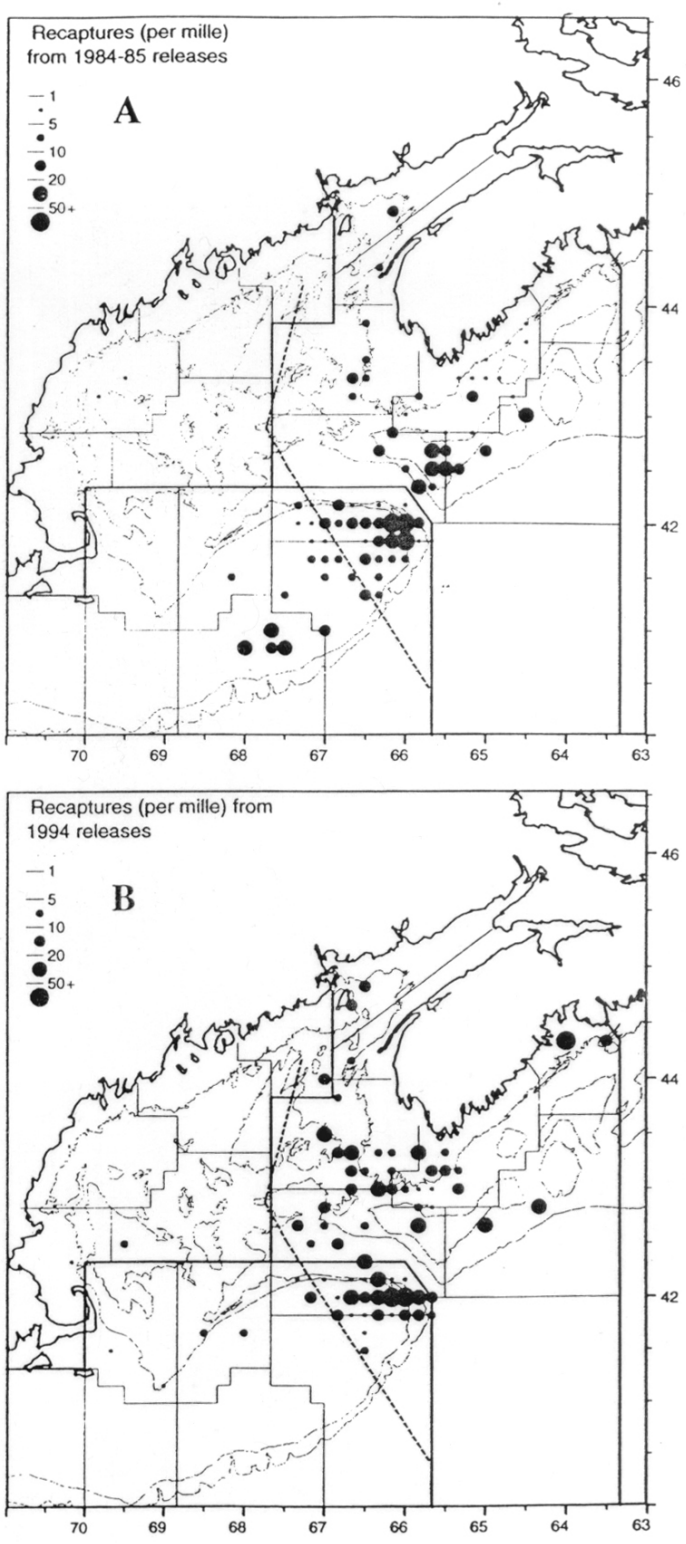
Mean catch per town of cod derived from 1982-91 U.S. research surveys in the Gulf of Maine area: (A) spring and (B) fall.

Distribution of adjusted cod tag recoveries from releases in the Browns Bank (4Xp) area, aggregated by 10 -min latitude and longitude squares.



Distribution of adjusted cod tag recoveries from releases in the Georges Bank (5Zj) area, aggregated by 10 -min latitude and lon gitude squares.





Distribution of adjusted cod tag recoveries from releases in the Georges Bank (5Zj) area, aggregated by 10-min latitude and longitude squares: (A) 1994 releases, (B) 1984-85 releases.

Figure 5: Juveniles

Fishing Community, 2001

❊ *Some fishermen refer to the northern edge of Jeffreys Ledge as "the incubator."*

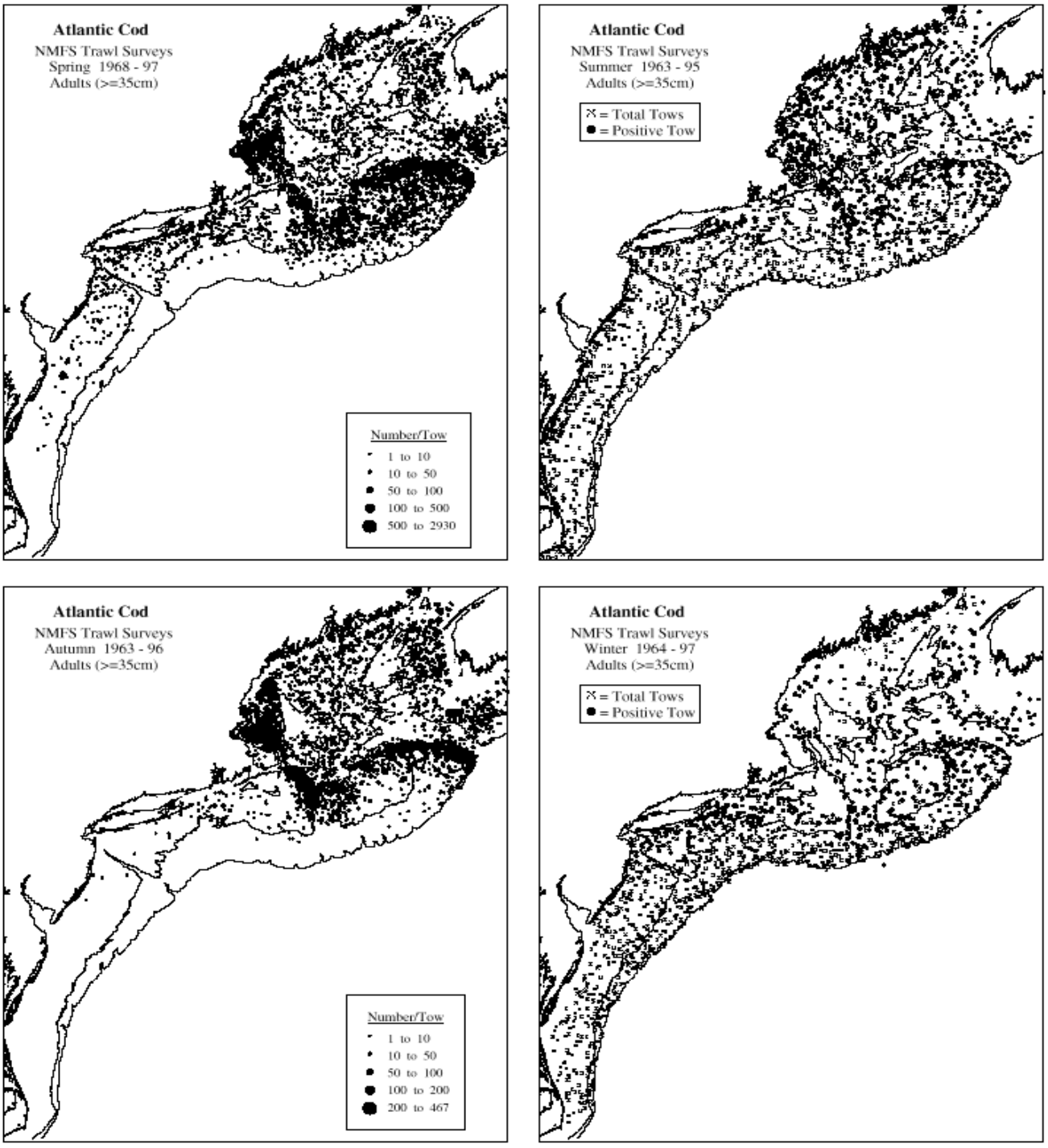
Juvenile fish are also found in Cobscook and Passamaquoddy Bays in winter/spring

Figure 6: Juvenile Concentrations

Wigley and Gabriel, 1991

Figure 7: NMFS Trawl Survey Adults

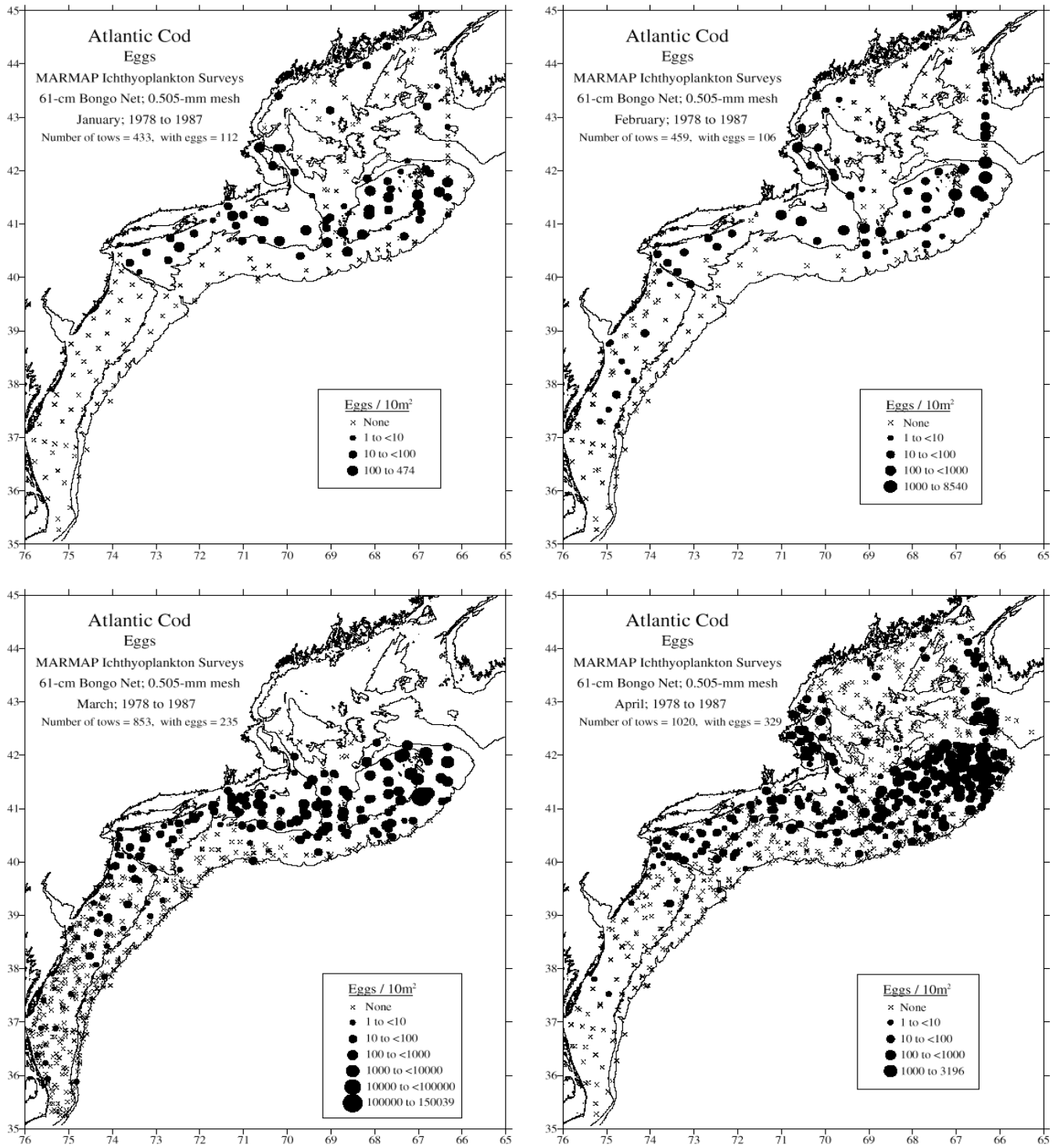
-NMFS, 1997



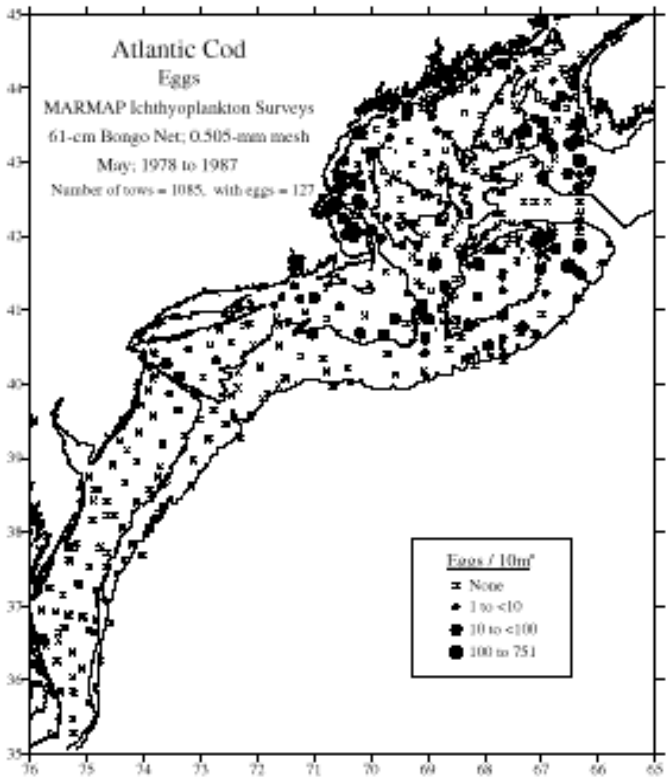
Distribution and abundance of adult (≥ 35 cm) Atlantic cod from spring (1968-1997), summer (1963-1995), autumn (1963-1996), and winter (1964-1997) NEFSC bottom trawl surveys. Densities are represented by dot size in spring and fall plots, while only presence and absence are represented in winter and summer plots.

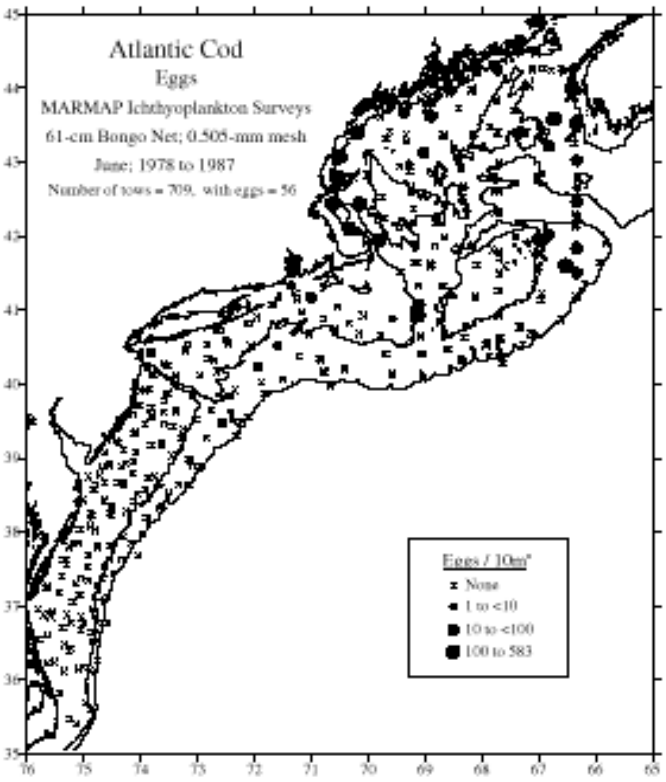
Figure 8: NMFS Trawl Survey Egg Concentrations

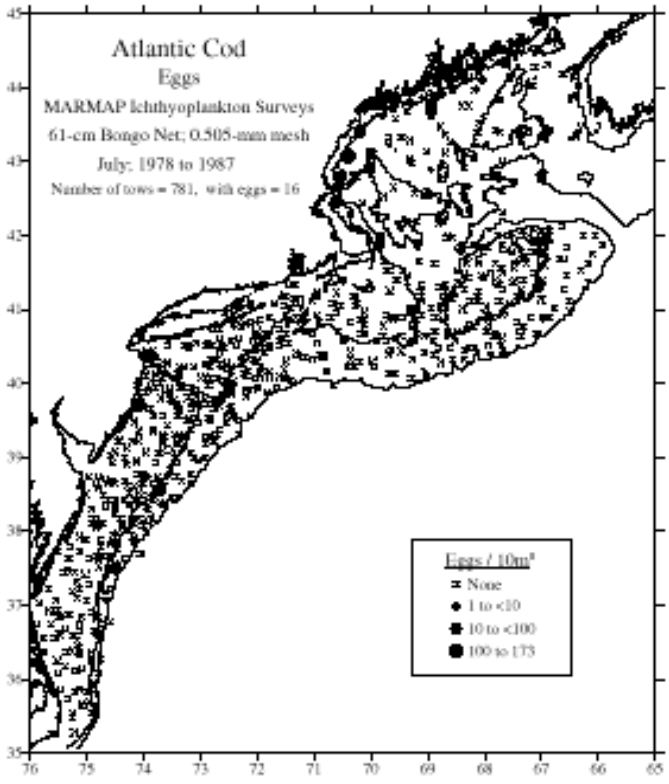
-NMFS, 1997

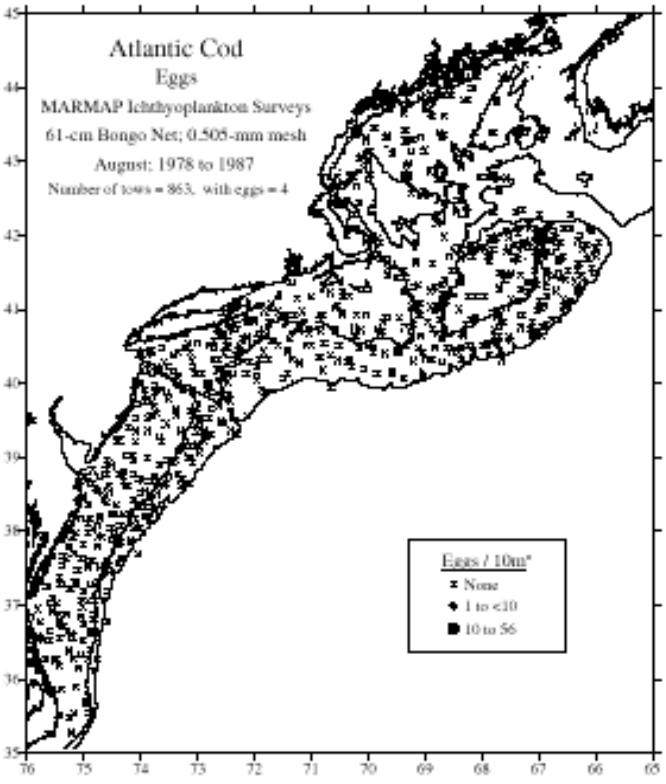


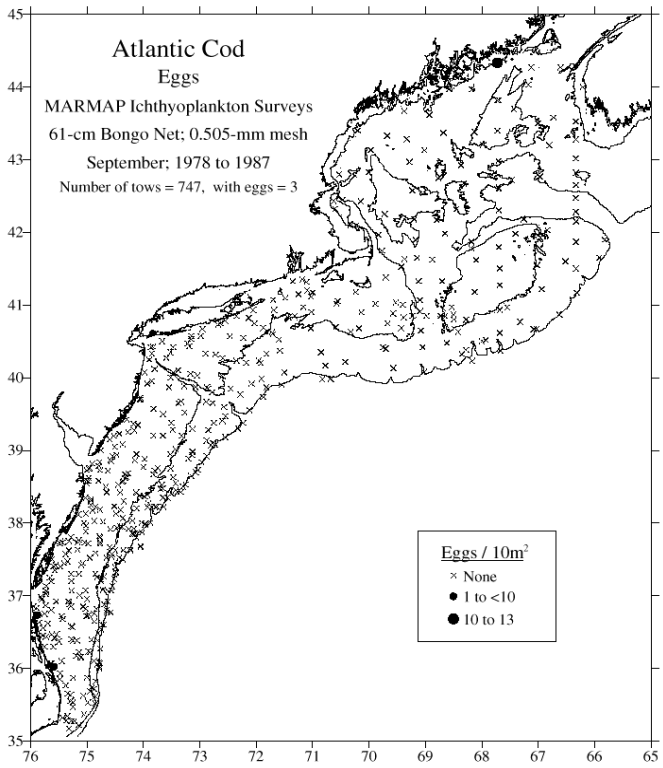
Distribution and abundance of Atlantic cod eggs collected during NEFSC MARMAP ichthyoplankton surveys, January to December, 1978-1987. Abundance is represented by dot size, and sampling effort is indicated by small x.

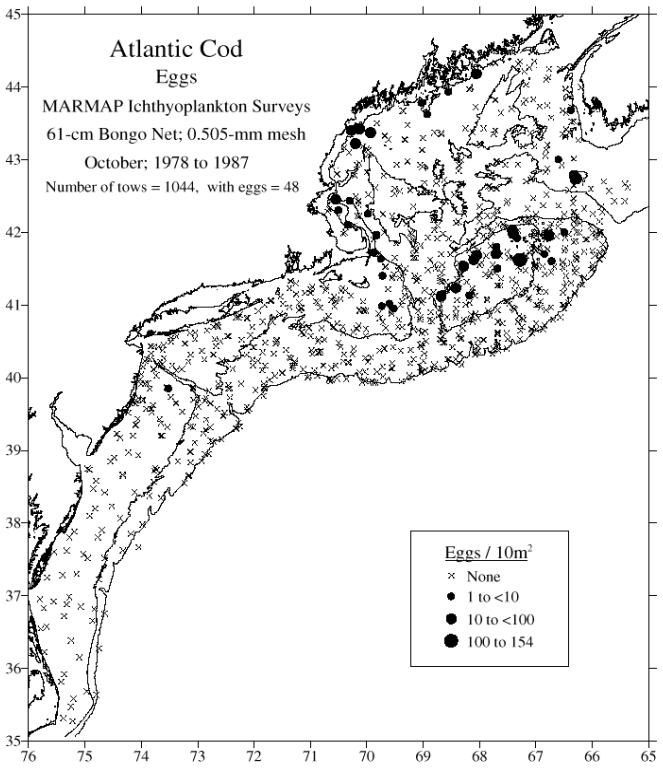

Atlantic Cod
Eggs
MARMAP Ichthyoplankton Surveys
61-cm Bongo Net; 0.505-mm mesh
May; 1978 to 1987
Number of tows = 1085, with eggs = 127
Eggs / 10m²
None
1 to <10
10 to <100
100 to 751

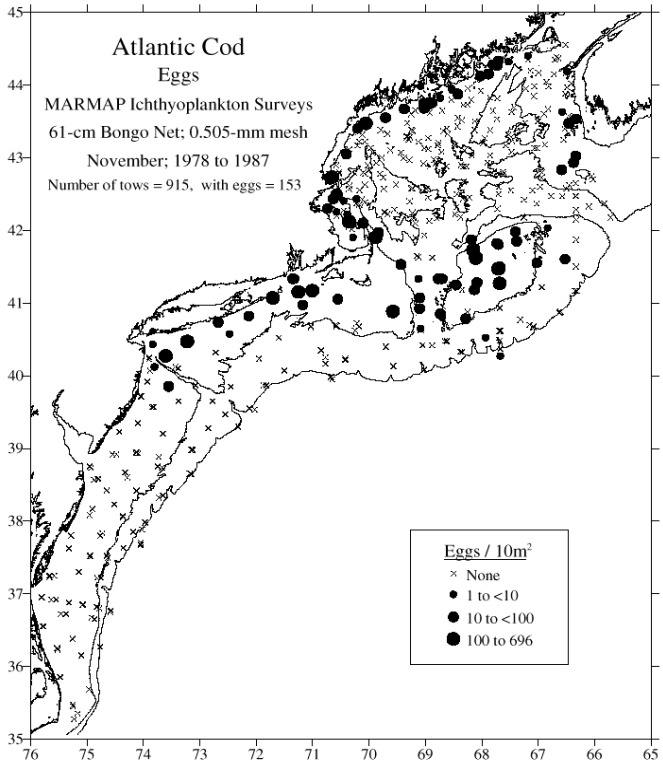

Atlantic Cod
Eggs
MARMAP Ichthyoplankton Surveys
61-cm Bongo Net; 0.505-mm mesh
June; 1978 to 1987
Number of tows = 709, with eggs = 56
Eggs / 10m²
None
1 to <10
10 to <100
100 to 583

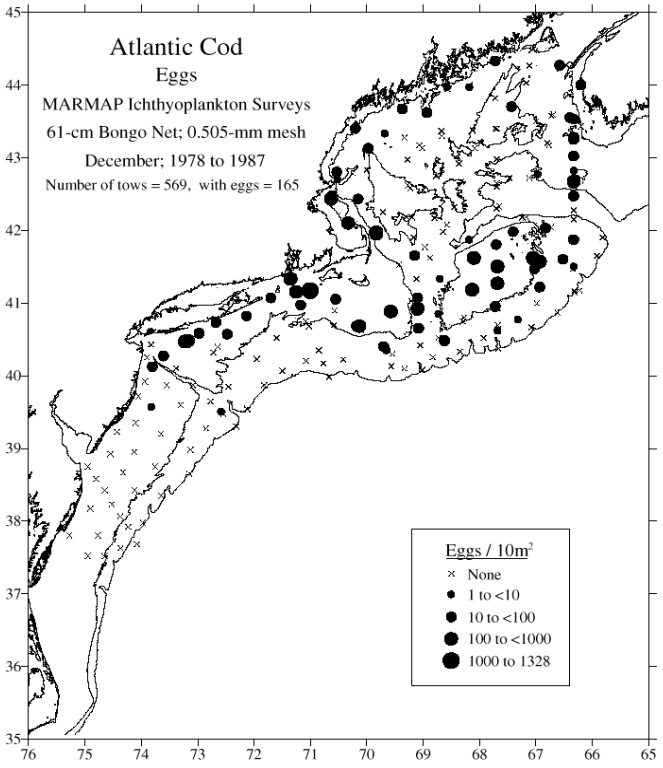

Atlantic Cod
Eggs
MARMAP Ichthyoplankton Surveys
61-cm Bongo Net; 0.505-mm mesh
July; 1978 to 1987
Number of tows = 781, with eggs = 16
Eggs / 10m²
None
1 to <10
10 to <100
100 to 173


Atlantic Cod
Eggs
MARMAP Ichthyoplankton Surveys
61-cm Bongo Net; 0.505-mm mesh
August; 1978 to 1987
Number of tows = 863, with eggs = 4
Eggs / 10m²
None
1 to <10
10 to 56


Atlantic Cod
Eggs
MARMAP Ichthyoplankton Surveys
61-cm Bongo Net; 0.505-mm mesh
September; 1978 to 1987
Number of tows = 747, with eggs = 3
Eggs / 10m²
None
1 to <10
10 to 13


Atlantic Cod
Eggs
MARMAP Ichthyoplankton Surveys
61-cm Bongo Net; 0.505-mm mesh
October; 1978 to 1987
Number of tows = 1044, with eggs = 48
Eggs / 10m²
None
1 to <10
10 to <100
100 to 154


Atlantic Cod
Eggs
MARMAP Ichthyoplankton Surveys
61-cm Bongo Net; 0.505-mm mesh
November; 1978 to 1987
Number of tows = 915, with eggs = 153
Eggs / 10m²
None
1 to <10
10 to <100
100 to 696


Atlantic Cod
Eggs
MARMAP Ichthyoplankton Surveys
61-cm Bongo Net; 0.505-mm mesh
December; 1978 to 1987
Number of tows = 569, with eggs = 165
Eggs / 10m²
None
1 to <10
10 to <100
100 to <1000
1000 to 1328

Appendices

Appendix 1: Cod-tagging Bibliography

Cod-tagging Task Force

Bibliography

Compiled by:

Jennifer Dianto, New England Aquarium
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Marjorie Mooney-Seus, Fisheries Consultant

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Appendix 3: Fishing Sector Recommendations for Cod-tagging Program

The Pros and Cons of Fish Tagging

In recent months, the New England Aquarium has gone to work for the National Marine Fisheries Service to develop recommendations for a centralized fish tagging program in New England waters. What happened is this. NMFS has a pool of money to give to fishermen who are interested in conducting collaborative fisheries research. Last year, a lot of fishermen sent in proposals to NMFS to conduct fish tagging programs. Rather than favor one tagging study or another, NMFS decided to hire the New England Aquarium as a neutral consultant to make sense of the whole situation. In response, the Aquarium constructed the Tagging Task Force and has hosted a series of workshops in many New England ports to discuss the interests of fishermen with regards to tagging and to get their input on program design.

Tagging meetings have been held up and down the coast and have met with a mixed reception. Fishermen who think the tagging results will help them at the New England Management Council are in favor of it and those that think that the results will hurt them are opposed. Once again, politics are playing one fishing group against another . In our discussions of fish tagging, we are letting our distrust of the government and how they might use this new information get in the way of a common objective… better information about our fish stocks. It is really too bad because despite political differences, we share a common goal to get better scientific data about fish movement from a well-designed tagging program.

For years, our objections to government science have resounded through politicians' offices. In response, we have been granted a golden opportunity to participate in collaborative research. However, collaborative research is a new process that must be explored with care. Like any process involving unfamiliar groups working together, the first step is to build trust amongst participants. To some folks, the following criteria may seem excessive but to those of us that have signed this letter, it is an acknowledgement of potential problems with the tagging program and recognition of the importance that fishermen and fishing communities build a future based on mutual trust, respect and understanding.

Successful design of the New England fish tagging program will benefit the fishing industry by:

- Establishing collaboration and trust between fishing organizations, scientists and policy makers.
- Establishing fish migration patterns over short and long time frames.
- Establishing fish movement across closed area boundaries.
- Monitoring growth rates for different fish species.
- Evaluate if fish tagging is the most effective technology for assessing fish movements and growth rates.

Working across gear sectors and ports, we have developed a list of criteria by which to evaluate whether or not the Tagging Task Force comes up with a valid scientific design. In evaluating the tagging program, the following conditions must be followed:

- Data must reside with a neutral non-government entity for a minimum of 5 years prior to use in policy development.

- The program must be long term with assurances of long-term funding commitments.
- Tagging programs should be designed for all New England managed stocks.
- Dedicated and paid tagging trips will maximize the number of fish tagged and should be utilized.
- To ensure consistency, scientists must conduct all tagging aboard dedicated tagging trips.
- An analysis must be conducted comparing those tags from dedicated trips and returned by fishermen with those captured by scientists to ensure that the data sets are the same.
- Prior to implementation, the program design must define where, when and how many fish to tag.

Adherence to strict standards of scientific protocol will ensure that the New England tagging program builds not only better scientific data for managing our fish stocks but a sound foundation of trust upon which to utilize that same information.

Paul Parker, ***Cape Cod Commercial Hook Fishermen's Association***
John Our, ***Chatham Gillnetters Association***
Maggie Raymond, ***Associated Fisheries of Maine, Groundfish Group***
Bob Lane, ***New Bedford MA***

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Appendix 5: Task Force Mission Statement and Research Questions

Mission Statement:
To develop a collaborative cod-tagging program that includes the active participation and involvement of fishermen, scientists and other interested parties in order to improve our understanding of the dynamics of local, regional and international cod movements while enhancing understanding of ecology, population characteristics and fish behavior towards improved management.

Focus of Cod-tagging Program
What do we hope to learn from this program?

I. Where do cod go, and when are they there?
   - A. Region-wide movements
     - i. Is there a circular movement of cod in the Gulf of Maine and Georges Bank
     - ii. How do Gulf of Maine/Georges Bank cod interact with nearby areas to the east and west
   - B. Finer scale movements
     - i. Movements within Massachusetts Bay
     - ii. Relationship between 4X and 5Y
     - iii. Relationship between eastern and western Gulf of Maine
     - iv. Relationship between deep water and shoal water
     - v. Movements within Central Gulf of Maine
     - vi. Movements between United States and Canada
     - vii. Other local questions
   - C. How do adult and sub-adult movements differ?
   - D. Where and when are cod spawning?
   - E. Is their spawning site fidelity?
   - F. Are the closed areas sources or sinks? (e.g., source: spawning site exporting juveniles, sink: fish go into an area and are no longer available to fishery)

II. What factors influence movement patterns?
   - A. Are there specific habitat types associated with movements?
   - B. How does spawning affect movements?
   - C. How do predator prey relationships, oceanography, etc. affect movements?

III. What additional management information can be collected as a complement to this program?
   - A. Growth rates
   - B. Improved fishing mortality data
   - C. Enhanced understanding of Fish behavior

IV. What additional management related questions can tagging shed some light on?
   - A. Value of closed areas
   - B. Value of arbitrary stock separation lines

V. What additional technologies and studies are appropriate to augment tagging?

Appendix 6: Task Force Meeting Summary I

NEXT Task Force Meeting Dates: *November 29-30, 2000* at Urban Forestry Center in Portsmouth, New Hampshire, *December 18-19, 2000* (location TBD)

Meeting Summary
October 24 and 25, 2000
New England Aquarium Conference Center
Boston, Massachusetts

Attendees
Kevin Chu, National Marine Fisheries Service
Carolyn Arnold, Commercial Fisherman
David Arnold, Commercial Fisherman
Sean FitzGerald, Marine Resources Inc.
Nick Anderson, National Marine Fisheries Service
Joseph Hunt, Department of Fisheries and Oceans, Canada
Ted Ames, Stonington Fisheries Alliance
Carl Bouchard, Commercial Fisherman
Bob MacKinnon, Massachusetts Bay Inshore Commercial Groundfish Association
Steve Murawski, National Marine Fisheries Service
Hunt Howell, University of New Hampshire
Phil Yund, Gulf of Maine Aquarium
Chris Glass, Manomet Center for Conservation Sciences
John Williamson, Fisheries Activist
Lou Goodreau, New England Fisheries Management Council
Craig Pendleton, Northwest Atlantic Marine Alliance
Kelly Penney, Commercial Fisherman
Ben Neal, Island Institute
Tom Currier, Massachusetts Division of Marine Fisheries
Ed Baker, School of Marine Science and Technology

NEAQ staff
Maggie Mooney-Seus, Facilitator
Christine Courtney, Conservation Associate
Jennifer Dianto, Conservation Associate

Presentation Summaries

Kevin Chu, National Marine Fisheries Service
Background
The purpose of the Cod-Tagging Program Task Force is to develop a series of recommendations to the National Marine Fisheries Service (NMFS) on how to implement a region-wide, cod-tagging plan. These recommendations will have broad based input from fishermen, scientists, and resource managers and could have significant implications for the management of cod.
The outcome of this first Task Force meeting shall be:

- To identify who we are as a team;
- To outline what we want to accomplish; and

- And to create a general game plan for the program.

We need to move quickly to in order to capitalize on available funding early next year. NMFS has asked the New England Aquarium to prepare a final report outlining three possible cod-tagging scenarios with a corresponding range of associated costs as a product of these Task Force discussions. We should first create a "dream" plan and then tier it down since we are not sure how much money we are going to get from Congress. It is anticipated that we could receive about $1.5 million in funding for this cod-tagging program next year.

Chris Glass comments: There also is the possibility of securing matching monies from non-governmental sources to compliment this effort.

Maggie Mooney-Seus, manager, New England Aquarium Conservation Department
Overview of Task Force Mission

I want to give you a little background as to why we are all here today. When the New England Aquarium developed its initial funding proposal to the NEFMC/NMFS last year, we suggested the need to pull together this Task Force to enhance our understanding of cod stock discreteness, specifically with respect to Georges Bank and Gulf of Maine cod stocks. With the help of this newly formed Task Force and broader industry input through a series of seven town meetings which will be held in January, we hope to flesh out this objective and make recommendations for a workable cod-tagging program design. The New England Aquarium role in this effort will be as a facilitator to record the work of this group, produce meeting minutes, coordinate meeting logistics and prepare the final report. We will not be involved in the actual implementation of the cod-tagging program.

Task Force Expectations

Due to the limited time frame for designing this program, meetings have had to be scheduled close together. It is not mandatory that you attend all Task Force meetings. However, we hope that you will try to make as many meetings as possible for continuity purposes. Since some of you will not be able to make all the meetings, we have to agree as a group that we can't rehash the same points of discussion in order to bring people up to speed. Given our tight deadline it is imperative that we continue to move forward. The onus will be on those individuals who miss meetings to find out what they missed. There will be a total of four Task Force meetings: three this year and one early next year. We also hope that Task Force members can attend or can help us organize at least some of the town meetings. We expect to hold seven town meetings in January.

Town Meetings

We plan to hire seven fishermen to help us set up the town meetings in January. The purpose of the town meetings will be to gain broader input from the fishing community on the program design and begin to identify program participants.

Presentations to review past and current cod-tagging projects in the region

Joe Hunt, Department of Fisheries and Oceans, Canada
A Presentation on Canada/USA Cod-tagging Initiatives and Results in the Gulf of Maine 1984-1998

It's very encouraging to see such broad representation coming to the table. We first need to define the geographical area we refer to as the Gulf of Maine. For this presentation, I define it as the area including Cape Cod, Georges Bank, southern Nova Scotia and up into the Bay of Fundy. This area is divided into unit areas designated by the Northwest Atlantic Fisheries Organization (NAFO). For our work as a Task Force, we need to define the geographic area we are talking about.

Based on past cod-tagging studies there appears to be well-defined areas of aggregation. For stock identification we looked at seasonal variations. While today there is an obvious difference in total density, there still seems to be some persistence in aggregations. To conduct the most recent Canadian tagging study a Department of Fisheries and Oceans (DFO) research vessel – a 160 foot stern otter trawl -- was used. This proved to be a viable way to catch and release fish if used in less than 50 fathoms of water with a 10 to 15 minute tow and a slower haul back. There was good survivability, cod are pretty robust.

Floy T-bar tags were used and attached with a specialized gun. All tags had unique serial numbers and two addresses (U.S. and Canadian). Tag retrieval was initiated by posting tag reward signs asking fishermen to report when caught, how caught, and the size of the fish, etc. when returning the tag. Seven dollars was awarded for each tag return. Rewards as an incentive to return tags should be discussed in greater detail during these Task Force meetings.

Once the fish are caught, they are stored in an eight foot long holding tank approximately four feet deep. Fish of all sizes were tagged; some of the largest were approximately 130 cm. Each fish is handled only once. It is measured, tagged, and returned to sea making for 15 to 30 minutes out of the cod's natural habitat. The difficulty of using a large trawler as a research platform is the amount of time it takes to get the animal back into the sea.

Return rates also are affected by exploitation rates. In areas of high effort there will naturally be more tags retrieved, and in areas of low effort, less tags may be retrieved. We also must take into account management regulations and their effects on reducing effort in areas. We also need to factor in closed areas and fishing seasons. And, the fact that abundance has dramatically changed must be considered (e.g., we have to recognize that dispersal may be different if abundance were high).

Questions and Answers

What was the longest period of fish at liberty? Six or seven years. The majority of captures occur over 2 to 3 years. And most fish tagged and released on Georges Bank were re-caught there.

Is there anything that shows seasonal cyclic migration? We have not addressed that, we were looking at the aggregate of the spawning season. Maybe we should release fish at different times of the year to see if they follow a pattern. I have access into our closed

areas for research so I can get a glimpse of what is happening in these areas because the Canadian cod fishery is closed until June. Overall, there is quite a bit of movement in the Gulf of Maine. Some of the results from tagging studies also indicate that some fish are recaptured in the same areas that they were released in (e.g., the majority of fish released on Georges Bank are recaptured on Georges Bank).

Did you have a dedicated vessel? Yes, one trawler.

Where was the fish tagged? Caudal fin, parallel to the orientation of the fish.

Can you plot currents over your maps to see if there is some correlation? Probably not so much with adults. However the integration of environmental factors such as currents and temperature could be useful.

What are the possibilities from multiple captures and returns? We must be sure to look at the time between recapture versus release. But there is something to be learned from catching the same fish again and following its movements.

What is the re-capture rate? There is a 10 percent return rate of tags -- that is high. One problem with tag returns is that there is a bias. How do you make it transparent to fishermen about the importance of turning in tags. This is something that we need to think about when designing this particular tagging program.

What is the percent of tag loss? Mortality was low on fish with tags. Tag loss depends on types of tags used, seasons, etc. T-bar tags worked well.

Steve Murawski, National Marine Fisheries Service
The History of NMFS Cod-tagging, Gulf of Maine and Georges Bank South

Between 1897 to 1901 Woods Hole Fish Propagation Unit, led by Hugh Smith, did tagging. Some 4,000 fish were tagged and released in December through February. Most of the fish went south off Newport, Rhode Island, down to coastal New Jersey.

Some of the more modern tagging studies span from 1923 to 1932 under Bill Schroeder. Tagging was done in Gulf of Maine. Fish were tagged east of Cape Ann. The study demonstrated inshore-offshore movement patterns. Further tagging was done during 1923 to 1929 in southern New England/Mid-Atlantic. Fish were tagged in the caudal area (not a good place to tag, used by fish to navigate).

The most important study was in the 1920s (1923 to 1929) off Cape Ann: three buoys, 22,228 fish tagged. It was found that the older fish tagged were more likely to move farther. Documented winter migration south as waters cooled -- down to New York Bight, Cape May, New Jersey, Chesapeake Bay. Today, never make it down this far. The southern extent of the migration may have been a result of fish chasing bait, but it was more likely in response to changing water temperatures.

During the 1950s, Jack Wise's work helped to devise our present stock definitions. Also seems to support Canadian studies that Joe Hunt, talked about earlier. The work was done off Chatham in March/April. Most of the recaptures were on Georges Bank with a few more to west -- fairly localized movements were demonstrated by this tagging study.

In February/March 1957, there was a tagging study during the spawning season off Chatham. There were 111 recaptures; 10 percent of the recaptures were north, near Cape Ann and Stellwagen, a few more in Maine waters on southern Georges Bank. During cold months, there was significant movement to the south. This is a key study.

However, there has been a lack of tagging effort since Jack Wise's last work in 1959.

Question for us today is given the apparent concentration in Massachusetts Bay, are we still seeing these historic movement patterns? Have to look at the size and condition of the fish -- pre- and post-spawn.

Stock identification in the past was determined by the difference in demographic patterns (such as growth rates) by looking at the otoliths to see if the fish were from the Gulf of Maine or Georges Bank South. There are differences in the rate of sexual maturity and in the distribution of eggs and larvae. The larvae tend to settle in a given area, the fish's growth pattern is then determined by environmental conditions in a given area.

Surveys in 1979 to 1981 and 1997 to 1999 show a pinching down in the distribution – fish are compressed into a smaller area. We need to be aware in our current fishing effort and the fact that the range will increase with population increase. We also need to think about what age groups we may want to target in this study to see what contributes to range changes.

There is a University of New York study underway which looks at genetic differences between cod from Georges Bank and Gulf of Maine. A pilot study looks at the otoliths in the Gulf of Maine and found different levels of lithium and magnesium in Gulf of Maine vs. Georges Bank fish. If we see changes in the ratio as animals age we can assume that they are occupying different water masses.

We might want to think about allocating some of the monies available through this tagging program for electronic tags. Since they can be quite expensive, it would probably not be feasible to use only electronic tags. Electronic tags exist that use pressure, temperature, light sensors (a proxy for latitude). We also can experiment with pop up tags/Global Positioning System (GPS) receivers. However, we should at least use archival tags (long battery life, and small) since just a few returns of archival tags will provide a wealth of information. These tags can provide temperature and depth data so we could infer movement along depth gradients weekly, daily or even hourly if we want that level of information.

One of the most important things we can do through this current program is consider various people's opinions about where fish migrate. We also must develop a testable hypothesis.

We must recognize the practicable limitations of tagging studies (e.g., tag shedding). To overcome this, we can observe fish in aquaria for periods of time, double tag fish, etc. Could also experiment with multiple tag types.

We also must keep in mind that the recapture effort may be a significant problem due to the various gear types in the Gulf of Maine and we must be sure to consider the "black holes" or closed areas.

Bob MacKinnon, SMAST Project
Mass Bay Commercial Inshore Groundfish Fishermen's Association

Currently tagging with School of Marine Science and Technology (SMAST) in areas 124, 125 inside the closed area of the western Gulf of Maine in January, February, March, and April (see Commercial Fisheries News article, October 2000)). I worked with Kevin Friedland to set up the operational design and have 50,000 "spaghetti" tags and 100 temperature/depth gauges ready to go into the water. *

Information on how to conduct the tagging study was shared by Arnie Carr of the Massachusetts Division of Marine Fisheries via personal communication and films. Various gear types, lobster boats, gillnetters, etc. will participate in the project. The tagging studies will be conducted in water above 30 fathoms and in fish from fourteen inches.

Questions and Answers:

What sizes of fish are to be tagged? All sizes are to be tagged.

Which gear types will be participating? All gear types will be participating, and it will be interesting to see recovery rates from different gillnets.

What are the incentives for returning the tags? The incentives for returns include holding a drawing or lottery.

What questions will the tagging project answer? The message of the tagging project will be just to get fishermen involved in collecting data. We think it is important to just get the program going. We hope to have a year round effort and then see what kind of information comes out of it.

What is the duration of the project? The project will be long term, and we currently have about $400,000 in state monies.

Who will be managing collected data? A student at SMAST will be coordinating the returns. All of the information collected will be made public.

What type of tags are you using? Floy, t-bar.

How will the data be disseminated? All information will be made public.

Steve Murawski comment: That last question about data dissemination is really important. When we are developing this current cod-tagging program, we should think about creating a website in which folks could download data. NMFS' shark tagging project even has an annual newsletter. We should think ahead to whom or what will be the Clearinghouse so we can create a generic return center that we can support in the long-term.

** UPDATE: SMAST is currently tagging in the Gulf of Maine, starting in Massachusetts Bay and expanding onto Jeffreys Ledge, east of Stellwagen Bank, down into the Channel area, out on Georges Bank. As of 4/16/01, SMAST has approximately 3,000 t-bar tags on fish and fish are being tagged on a daily basis. SMAST has over 45 tag kits on boats spread throughout the Gulf of Maine and Georges Bank. In total, SMAST expects to distribute 50,000 t-bar tags. To date,

approximately 74 temperature/depth tags have been put on large cod in the Massachusetts Bay, Stellwagen Bank area. The remaining 26 depth/temperature tags are expected to be distributed by May 1. David Martins, Frank Bub and Bob MacKinnon worked together to set up the operational design of the program. All gear types are involved.

Hunt Howell, University of New Hampshire
Current Tagging Effort

I am conducting a study funded by the Northeast Consortium looking at when fish move in and out, or small scale movements, in the closed areas of 139, 140, 132, 133, 124, and 125. Sampling has not yet started, but we intend a project duration of November, 2000 to October, 2001. We believe fish are moving south to north from spring to summer. We want to learn if some of these fish move across the Gulf of Maine. Eight commercial fishermen are involved to get a return of 5,000-6,000 of a variety of groundfish species. All vessels are trawlers conducting short tows, putting the fish in tubs on deck, and tagging only those that outwardly show healthy vital signs. We would like to use data storage tags as a current project is on-going in Iceland with data storage tags.

Questions and Answers:

Do you have dedicated draggers? Boats will be chartered, making short tows in shallow water using six inch mesh gear.

Could the programs use smaller mesh sizes to catch more fish? Kevin Chu replied that they would need an Exempted Fishery Permit from NMFS.

Do these count as buyout days? No, each fisherman is paid a daily wage, no fish are landed.

What steps have you taken to get tags back? Return is encouraged by placing posters where fish are sold. We also plan to advertise in trade publications and communicate with people at various ports, etc. There are no rewards in the budget. However, information will be sent back to each individual who requests it, after they turn in a tag. We hope that will provide fishermen with incentive to participate.

How many tags will you put out there? 35,000 tags.

Phil Yund, Gulf of Maine Aquarium
Proposed Projects

We are exploring the possibility of developing a cod and herring tagging project, but currently nothing is underway. The project would be hypothesis driven, and all of the information would be shared. The project would look at the higher tech tagging methodologies available.

Acoustic tags that look like capsules are less than one inch in length and send out a signal that can be picked up by a receiving hydrophone up to 1 km away depending on weather. This system can track individual fish and can be useful in closed areas. Therefore, we can follow migration of individuals or can put receivers on moored buoys, which can record fish passing by.

Again, this would be an effective mechanism for monitoring closed areas or answering localized questions.
Some tags have adapters to transmit depth, temperature, etc. The big concerns are the expense of these systems since the receivers can be $10,000 each. They also have a limited battery life and are only good for approximately one to two years.

Another tagging technique uses coded wire tags. A small capsule is implanted into the fish, which contains a crystal. The crystal resonates when exposed to an electromagnetic field detection system as fish are being offloaded from boats. This is not ideal for cod.

Cod tag returns can be rewarded by a lottery system, basically a drawing at the end of the year. A value of about $1,000.

Questions and Answers:

Chris Glass comment: Hydrophones are very susceptible to noise. Subsurface buoys can help so that winds and weather do not block the range of transmission.

Steve Murawski comment: Subsurface moorings are currently being used for salmon. We have found that 50% of smolts were lost due to predation by using an acoustic system. Receivers are implanted and take a lot of maintenance but give us high quality data. The open ocean is too vast for this type of technology, but it may work for closed areas.

Unidentified comment: four or five reward systems for different projects being conducted by various groups throughout the region may confuse people. There should be some standardization. Why couldn't we set up a multi-species clearinghouse?

Ted Ames, Stonington Fisheries Alliance
A Presentation on the anecdotal evidence of cod movements

I based my analysis on the work of Walter Rich which was published in 1930. Basically he was working in an area that wasn't captured by the tagging studies that Steve and Joe discussed earlier. I was looking at very localized, in-shore areas, where there used to be fish. Based on what I have learned by talking to fishermen is that the fish just aren't there anymore. This is a historical spawning grounds study looking for repeating patterns. We have enough anecdotal and hard data to begin looking for possible tagging sites along the coast because a small number of fish do come into the area, it might be worth seeing where they come from and where they go.

According to historical information we have more than one stock in the Gulf of Maine. The overwintering locations may be key to understanding how cod populations work and how we might be able to make better management decisions. Cod-tagging with existing surveys would be a powerful tool.

Questions and Answers:

Steve Murawski comment: Based on what Ted just presented, it seems that we should also pay attention to the Gulf of Maine/Western Scotian Shelf areas. There is some good recruitment and survivorship up there. There also is good spawning on the Scotian Shelf, which may feed the rest of the Gulf of Maine via circulation patterns. Even though it will

be difficult to tag since there aren't many fish left up there, the counter clockwise Maine coastal current is essential for our understanding of cod movement.

Over the next day and a half the group engaged in open discussion to begin to create a working document outlining some preliminary goals and objectives for the cod-tagging program. Here are some of the products of their discussion:

Participants were asked to state what they personally wanted to achieve from a cod-tagging program. There responses included the following (not prioritized):

- To learn more about stock definition, structure, fish behavior and distribution patterns
- To bring together local projects in a unified effort
- To assess whether there are localized stocks
- To identify specific habitat types associated with movement
- To effect a change in management
- To associate age of fish with habitat types
- To understand mixing rates between Georges Bank and Gulf of Maine Cod and understand reasons for observed movements and what drives the process for prediction purposes
- To understand major discrete stock components and movement patterns (i.e., how do local stocks relate to major migrations and total productivity?)
- To better understanding of the ecology of cod (e.g., Is it a key stone species?)
- To create a new model for scientists and fishermen to work together. Get scientists on fishing boats
- To provide an opportunity to upgrade technology applied to fisheries research
- To evaluate the assumptions of the unit management approach to stock assessment
- To identify spawning areas – tag fish, assess movements and verify where fish spawn
- To learn more about sub-adult movement patterns
- To examine interaction between U.S. Georges Bank and Canadian zone
- To help members of stakeholder groups understand where their fish are going
- To observe preferred habitat types and changes over the years
- To create a model for future projects, and to influence and change management
- To promote public access to data
- To keep the academic community involved
- To assess whether closed areas have been appropriately placed
- To conduct targeted genetic studies and collect ancillary data (e.g., life history data, stomach contents, salinity, water quality etc.) to complement this program. Want to encourage fishermen to turn in entire fish not just tag, at least in some cases
- To foster collaborative research projects with the Canadians

Group was asked to discuss the best approach for obtaining information through cod-tagging:

Chris Glass comment: We can't go further until we decide on the questions we want answered by this tagging study. We should spend time focusing on this, and perhaps then prioritize the questions.

Bob MacKinnon comment: Many fishermen are looking at how this can influence management. Cod-tagging is only the beginning. We need to build trust by making data public and having it come from a reliable source and making it accessible. We just need to get as many tags out there as possible, conduct a year round program and see what we can learn from it.

John Williamson comment: We must devise a master plan for the mechanics of tagging. Either we create guidelines for NMFS and the Northeast Consortium to fund and/or we send the guidelines to the New England Fisheries Management Council Research Steering Committee so that they can develop research priorities. Basically, we are recommending what types of projects funders should be supporting.

Steve Murawski comment: It is reticent to do a lot of work without focus and clear thinking to resolve outstanding questions. With that we can move forward. We should start ticking off questions.

Bob MacKinnon comment: The data must be distributed in a timely fashion and collection must occur over at least an eight year time period.

Kevin Chu comment: We must iron out questions and then run them by fishermen to see if they are of value to the fishing community.

Chris Glass comment: Collecting more data isn't always good. We must ensure that we get the maximum benefit from the data by asking the right questions.

Phil Yund comment: I agree with Chris Glass that we must come up with the questions first to best direct the program.

Steve Murawski comment: When the fish are recaptured we should do a total work-up to get all the data we can instead of just getting the tags and basic location information. We should create a protocol on the data coming back. It would be nice if we could encourage the return of the whole fish not just the tag so we can gather more detailed data.

The group proceeded with developing some preliminary questions and revisiting them over the course of the day and a half of discussions. Everyone agreed that these questions were a starting point and that they would be modified and or added to over the next few months with greater input from the fishing community.

- Testing the circular motion of fish from southern boundary of the Gulf of Maine/Georges Bank and consider how it relates to local subpopulations. A clear signal from people shows that this is their mental model of how things work. This depends on what we think is the bottom of the gyre. We should sample fish to assess not just movement patterns, both spatial and temporal, but also things like actual fish age and size variations and prey.

- Examine inter-relationship between Western 4X fish and Northern 5Y area cod.

- Look at the relationships between Western Georges Bank and Eastern Georges Bank cod. (Great South Channel).

- Are closed areas sources or sinks? For instance, are they places where fish don't come out of or are they net exporters of juveniles?

- What can we learn about particular habitat utilization? Are there specific habitat types that can be associated with movement patterns? What about the role of ship wrecks, bottom types, salinity, etc.? It might be worth conducting a small-scale acoustic survey as part of the larger cod-tagging program to answer this particular question.

- Where do cod in Massachusetts Bay come from? Where do they go? They come in, spawn, and leave, and that's just one area where this happens.

- The 42/20 line is a political boundary. Does that boundary make sense?

- Does the productivity in the Gulf of Maine depend on a layer of reproducing fish that are now gone? If we re-establish these fish, can cod come back? Can we look at over-wintering groups to figure out if they go back to the same area to reproduce? If they do, maybe we can do something to get the productivity back up.

- Are there very localized groups and do they inter-relate with larger migratory groups?

- Is there deep water/shoal water movement?

- What is the population of the codfish in the central portion of the Gulf of Maine (Cashes Ledge along the Hague Line) and Eastern Gulf of Maine and what is their relationship to fish who spawn in Western Gulf of Maine, etc.

- Can we unravel the role that cod play in the ecosystem?

- Is there a presence or absence of feeding fish (e.g., herring) etc?

- Are the closed areas producing spawning fish? This will require complimentary studies to answer – not just a tagging question.

- Would there be management actions/results to come from this data? Do we expect a management action to occur from the data?

- What would happen to specific areas that are tagged on a year round basis? Would the fish leave or stay? We should target those same areas to observe.

- Where do fish go to spawn? Is there site fidelity (returning year after year) to a spawning site?

- Can we differentiate between spawning stocks moving through an area and sub-stocks that actually stay in the area?

- What are the specific movement patterns of the sub-adults?

- What are the inter-relationships of the cod south and west of the Cape? (Mid-Atlantic) What are the stock movements, if any?

- What is the interaction between the Northeast Georges Bank and Canadian zone cod?

- Can we evaluate exploitation rates by looking at tag re-captures?

- What can we learn about various growth rates of different migratory groups through tagging?

Based on these discussions a more refined list of questions was formulated by the group.

Questions regarding stock identification through movement and location
- Can we test the circular motion of fish?
- What are the inter-relationships between western 4X and 5Y?
- What are the inter-relationships between eastern/western GB?
- Are there localized groups deepwater/shoal water movement patterns?
- What population of cod are in central GOM and eastern GOM?
- Identify the spawning areas, assess movements and figure out where do fish go after they spawn?
- What are the inter-relationships of fish south/west of Cape Cod?
- What is the interaction between northeast Georges Bank and the Canadian zone?
- Can we apply these questions to sub-adults?

Specific questions
- What specific habitat types can be associated with the movements of cod (this includes salinity, shipwrecks, and other environmental factors and features etc.)
- How can we evaluate exploitation rates based on tag recaptures?
- What are the various growth rates of migratory groups?

Questions related to assessment of the effectiveness of existing closed areas
- Are closed areas sources or sinks?
- Are rolling closures producing spawning fish?
- What is the value of the state of Maine closures and other state closed areas?

Open Discussion about proposed Movement Questions:

Chris Glass comment: We should approach the town meetings with this list, and let the fishing communities contribute to it, and get more specific.

Ted Ames comment: Can we add to this list? “What, if any, relationship exists between Kettlebottom and Sheepscot? What is the relationship from where the Saco Bay fish come from?” Questions like this should be put into a sub-group.

Phil Yund comment: The "movement questions" are going to come into two different forms: either open-ended questions (e.g., Where do the fish come from?) or specific hypotheses.

Dave Arnold comment: If we get too specific folks from different areas will get turned off since we may not include areas that apply to them.
Steve Murawski comment: Make it clear that the list of specific areas is just an example and encourage public meeting participants to share what would be relevant to their area.

Ted Ames comment: Could ask fishermen who will be helping you set up local town meetings to provide you with some local examples of movement patterns or could just leave it open ended so fishermen can provide their own examples during the town meeting.

Phil Yund comment: We should ask not only where, but also when these movements happen. This should apply to all questions. As we solicit examples from the public we have to be careful to ask where and WHEN.

Steve Murawski: The purpose of this cod-tagging program also is to help us connect the snapshots provided by government surveys to improve management.

General Comments to Specific Questions:

Kevin Chu comment: You would need additional information to address these, not just cod-tagging data.

Steve Murawski comment: We could use information, like that provided by Ted's historical/ancillary studies, to give more information on diets.

General Comments to the Closed Area Questions:

Lou Goodreau comment: We have three vastly different types of closures. Large closures were for spawning originally, but are now year round. Rolling closures are for spawning and started inshore but moved offshore. We may want to talk about what kind of closures we are talking about.

Ben Neal comment: Can we add to Closed Area Effectiveness questions: "Do Maine state closures really protect spawning stocks? What is the value of state of Maine closures?"

Group also involved in a map exercise. Asked to draw on a map of Gulf of Maine/Georges Bank where they think fish go and come from. It also was agreed that this was a worthwhile exercise to bring fishermen into the discussion and that the map may be a good means for opening the town meetings. Prior to the town meetings we should test this idea further by sending maps to people invited to serve on the Task Force which included some 50 or so names. Question we need to ask people is: Where do they think the fish that they fish come from and where do they go after they leave their fishing area?

The group also developed a mission statement and a more simplified focus for the cod-tagging program (see attached).

Some topics for November Cod-tagging Task Force meeting:
How to get the tags on the fish
How to get tags back
Discern where we want to tag
Discuss concept of a central tagging data Clearinghouse

Assignments prior to next meeting:
Distribute meeting minutes (NEAQ staff)
Conference call to look at calendar of upcoming research meetings to minimize timing conflicts (Kevin Chu, Maggie Mooney-Seus, Chris Glass, Phil Yund, and Jennifer Dianto)
Send out maps to broader Task Force to record mental models (NEAQ staff)
Create Bibliography for the Task Force (Chris Glass, Steve Murawski, NEAQ staff)
Logistics for next meeting (NEAQ staff)
Logistics for town meetings: identify fishermen partners and locations, run announcement in Commercial Fisheries News, etc. (NEAQ staff)

Appendix 7: Task Force Meeting Summary II

NEXT Task Force Meeting Date: *December 19, 2000* at the Urban Forestry Center in Portsmouth, New Hampshire.

Meeting Summary
November 29-30, 2000
Urban Forestry Center
Portsmouth, New Hampshire

Attendees
Ted Ames, Stonington Fisheries Alliance
Nick Anderson, National Marine Fisheries Service
Carolyn Arnold, Commercial Fisherman
David Arnold, Commercial Fisherman
Rollie Barnaby, University of New Hampshire Cooperative Extension, Sea Grant
David Bergeron, Massachusetts Fishermen's Partnership
Carl Bouchard, Commercial Fisherman
Donald Clark, Fisheries and Oceans, Canada
Thomas Currier, Massachusetts Division of Marine Fisheries
Kevin Friedland, UMASS Amherst
Chris Glass, Manomet Center for Conservation Sciences
Eric Geothel, Commercial Fisherman
Charlie Good, Commercial Fisherman
Jennifer Graham, Center for Community-Based Management, Canada
Joseph Hunt, Fisheries and Oceans Canada
David Lincoln, Gloucester Fishermen and Families Assistance Center
Robert MacKinnon, MA Bay Inshore Commercial Groundfish Association
Dale Martel, Commercial Fisherman
David Martins, School of Marine Science and Technology, SMAST
Earl Meredith, National Marine Fisheries Service
Benjamin Neal, Island Institute
Kelly Penney, Commercial Fisherman
Maria Recchia, Center for Community-Based Management, Canada
Brian Smith, New Hampshire Fish and Game
Mark Terceiro, National Marine Fisheries Service
Phil Yund, Gulf of Maine Aquarium
John Williamson, Fisheries Activist

NEAQ Staff
Maggie Mooney-Seus, Manager
Jennifer Dianto, Conservation Associate

Highlights
The group reiterated that all of the questions identified at the first Task Force meeting should be explored to enhance understanding of not only cod biology, behavior and movements but also the regional ecology. However, for the purposes of moving forward and devising a regional

cod-tagging program to further understanding of mixing rates between Georges Bank and the Gulf of Maine, which was the rationale for assembling the Task Force initially, it was agreed that the Task Force should flesh out the scientific methodology for the following question:

Question:
Is there a circular movement of cod in the Gulf of Maine and Georges Bank?

Hypothesis:
There is a circular movement of cod in the Gulf of Maine and Georges Bank.

Assumptions:
In the spring cod branch off up the coast. It may be that they go back to where they came from initially. It also is believed that young fish stay relatively local then move on when they mature.

There are nodes where cod over-winter. Were they pre-spawning aggregations?

How do we go about proving or disproving this hypothesis and these assumptions?
Objectives:

I. Tag inshore spawning aggregations along Massachusetts, New Hampshire and Maine coast;

II. Tag juveniles year round – focusing on two year olds (around 15 to 16 inches), as smaller fish do not survive tagging. We want to catch them just before they are old enough to spawn. We must tag in areas associated with spawning (e.g., Georges Bank) and areas that are not associated with spawning; and

III. Tag offshore spawning aggregations (e.g., Georges Bank, Great South Channel, and Central Gulf of Maine coast).

Funding allocation recommendation:
Available collaborative research monies for next year should be allocated in the following manner: roughly 80 percent of the funds should be used to conduct research in inshore areas and the other 20 percent should be allocated to conduct offshore spawning area studies (III). To further monies, we should examine possibility of using current Observer Program and/or college students to help conduct offshore component of this program.

It was recommended that this should be a multi-year program.

Methodology:

Research Platform/capture method
It was agreed that fishing vessels, primarily dedicated trips, should be used to implement the three objectives of this cod-tagging program. However, it may be appropriate, especially to answer some of the more specific questions identified during the first Task Force meeting, to enable other fishing vessels to participate in various tagging efforts using a non-dedicated trip.

> Boat Time
> Compensation for vessel time was discussed and there was some agreement that it would be worthwhile to compensate for boat time in the following manner: small vessels should be paid approximately $1500 per day/trip and the possibility of providing larger vessels with DAS (days at sea) should be explored. It was pointed out that current tagging programs do not compensate for vessel time and that a new precedent for future work would be set here.

For some vessels experimental fishing permits would have to be secured to allow them to fish with smaller mesh. Head boats and lobster boats also were suggested as particularly valuable platforms for recapture of juveniles. It also was pointed out that participants must try to tag in areas where juveniles are known to be present and must be sure to record size of fish at capture.

A suggestion was made to contract a travelling boat to pick up tags and samples from fishing vessels that catch cod that are not on a dedicated trip.

It also was suggested that recreational vessels might be effective means for learning more about juvenile fish (getting around the need for small mesh exemption permits) and gaining access into closed areas to collect tag returns.

It was suggested that the program should be put out to bid to determine who would be best qualified to implement it.

Information that might be learned from the program:
Objective I: Transboundary information (particularly relative to the Hague Line), life history information, a basis for tracking the movement of spawning fish (have to collect state of maturity, by cutting open the fish on deck), some time/distance information (e.g., learn how much time has elapsed between capture and release), for management purposes could actually identify when fish come into spawn, may be able to determine when might be most appropriate not to fish, and could help with stock identification.

Objective: II: Where juvenile fish are coming from and where they go; if program is conducted over a number of years will be able to see when juveniles start entering the fishery, may learn what happens as they mature and see variations in their patterns of movement (e.g., as they mature do they return to the same spawning ground or do they scatter?), off Newfoundland there is a belief that the offshore feeds coastal nurseries – may learn if this is the case off U.S. coast and could also collect time/distance information.

Objective: III: Same as for Objective I and II.

Minimum Time at Large
Objective I: If cod come back a year later to the place where they are released.
Objective: II: What movements juvenile fish make. We must be sure to tag large enough numbers of fish to ensure that we are still getting returns when we expect that fish will be joining spawning.

Maximum Time at Large
For all three objectives, this really depends on the level of continued funding.

Recapture Potential
For adult fish (Objectives I & III) if we are going to be tagging during post-spawning, there may be high level of mortality. Also during summer months because of the fact that we will be bringing fish through a thermocline may have higher mortality. In winter, have issue of freezing conditions on deck that will affect survivorship. All will affect recapture potential.

With juvenile fish (Objective II), presumably the recapture rates are expected to be low at first (from smaller fish), so you have to tag enough to get a reasonable return rate.

Tag Type
There was consensus that for the purposes of answering the identified question and conducting research programs to achieve the three objectives, it would be best to use conventional tags (e.g., T-bar or spaghetti, etc.). It was agreed that some samples of fish should be double-tagged to learn more about which type of tag works best. In addition, it was thought that in some instances we might want to use a data storage tag or some other high-end tag to get some complimentary information and answer some of our more specific questions. It was suggested that somewhere between 25-100 fish should be tagged per day using the conventional tag, depending on gear type, length of tow (should be short tow), season, environmental conditions, etc.

Release Numbers
Objective I: The numbers should be large. We can assume about a 5 to 10 percent recapture rate based on similar sized Canadian studies. We figure around 10,000 tags per state/30,000 total for inshore areas; or at least 5,000 tags per 30 minute square. For Maine (Mid-coast and east) you may have to subdivide the squares.
Objective: II: 2,500 to 3,000 tags per geographic area to get some idea of recruitment.

Fish Size
Objective I: Adult fish should be tagged.
Objective: II: Juvenile fish, pre-spawn (15 to 16 inches)
Objective: III: Adult fish

Release Time
Objective I: During closed season, winter, fall and early spring
Objective: II: Year round
Objective: III: Year round

Coordination
There was widespread support for having local coordinators to identify participants for the program, conduct training, distribute tags and collect data. It was felt that it might be best to train local fishermen or fishing organizations (e.g., NAMA, Maine Lobstermen's Association, Massachusetts Fishermen's Partnership, Fishing Cooperatives, etc.) to serve in this capacity.

Everyone agreed that training was a high priority and more thought needed to go into designing an effective training program.

Tag Returns

There seems to be broad-based support for putting a 1-800 number on the tags. However, a point was made that 1-800 numbers must also be in place for Canadian returns. It was suggested that it might be best to have two sites, preferably non-government agencies, one in the United States and one in Canada where fishermen could send in their tag returns.

When tagging juveniles, we can expect to see answers to most of the questions that we are trying to answer within the first annual cycle as after that fish will not be available to the program.

Incentives

- While this question remained opened. There was strong support for the idea of a dual lottery for fishermen; both participants who tagged fish and individuals who returned tags. It was agreed that the lottery should be sizable enough to make it worthwhile (at least a few thousand dollars) and that it should be held annually. There also was some agreement that each fisherman who returns a tag should receive a small gift (e.g., a hat).

- Suggestions were made to fully utilize existing mechanisms within NMFS, etc. to communicate survey results (e.g., newsletters), but the idea of establishing a website and using return postcards for fishermen who do not have access to the internet to provide them with some basic information about the fish/tag they turned in also were considered important means for encouraging fishing community involvement in the program.

- There was some discussion about the ability to use federal monies to compensate Canadian fishermen who participate in the program (either in the actual tagging of fish or in returning tags). It was agreed that Canadian fishing industry participation is crucial to the success of this program and that means should be explored for compensating them accordingly. A couple of options were discussed. The possibility of giving each Canadian fisherman a hat which may be purchased out of a centralized pool of monies and securing private funding or matching DFO monies to cover the expense of a Canadian lottery program were recommended. It also was suggested that it might be nice to have some Canadian fishermen tagging fish as part of this program, perhaps DFO and non-government scientists in Canada could be supplied with a bunch of tags that they could distribute in Canadian waters.

- We may want to approach fishing organizations to ask them to contribute to the annual lottery pool. This also may enable us to get around problems of distributing U.S. federal “disaster relief” monies to Canadian fishermen.

- It was suggested that a quick literature review of the benefits of compensation programs (in terms of enhanced return rates) would be worthwhile.

Reciprocal Study
In all three cases, it would be good to have a reciprocal study in Canadian waters. However, the highest priority for a reciprocal Canadian study would be with respect to achieving Objective I. In addition, to achieve Objective I, it would be good to do some tagging on Georges Bank.

Centralized Clearinghouse
Recognizing that there are already several cod-tagging projects underway or proposed in Gulf of Maine/Georges Bank waters (e.g., SMAST, Center for Community-Based Management/DFO, Tim Tower's program etc.), it was agreed that a Centralized Clearinghouse should be established for coordinating efforts.

Criteria for a Centralized Clearinghouse

- Identifiable as an independent entity specific to this cod-tagging program.
  - If the Clearinghouse was established as a separate entity but still could take advantage of some of the existing infrastructure of an established organization such as SMAST, UNH, Manomet, and Island Institute, etc, this may enable us to maximize available federal monies.

- Should be a neutral third party to house, manage and conduct some of the analysis of the data.

- Need to ensure targets of the program are being met in the various areas where the program is being implemented, as it may be that research methodologies must vary by area/gear type to maximize the dispersal and return of tags.

- Should have access to community-based groups for building support for the program and disseminating program results (e.g., fishing cooperatives, NAMA, Bay of Fundy Marine Resources Center, and Center for Community Based Management, etc.).

- Must have capability to make the data readily accessible to all interested parties in a timely manner.
  - Need to have plan in place for how data are going to be distributed.

- Should have capability to mount historic data and make data compatible with collected data (A point was raised that SMAST has this ability).

- Should have adequate storage space for samples (freezer) and analytical capabilities.

Ancillary Programs
There was some consensus that additional studies must be done to complement a regional tagging program. A suggestion was made that since this list overlaps with some of the work of the Sentinel Fisheries Program, there may be room for collaboration.

- Collect samples.
  - Fin clip to be analyzed for genetic differences at some later point in time (e.g., need, at minimum, 50 individuals per area of interest)
  - Also need to get a representative biological sample from each area to confirm age structure (otolith)

- Important to confirm maturity state (may need to have a biologist on the boat to do dissect the fish on deck).

- Tag loss/differential mortality of tagged fish – need to consider holding experiment to assess survivability.

- May want to collect information on surface water temperatures, season, bottom type and depth. May want to overlay with information collected from USGS or have fishermen collect as part of their daily/trip report.

- Species co-occurrence (belly samples) would be worth better understanding.

Appendix 8: Task Force Meeting Summary III

NEXT Task Force Meeting Dates: *February 15-16, 2001*, New England Aquarium. Please try to attend town meetings in your area (see attached schedule)

Meeting Summary
December 19, 2000
Urban Forestry Center
Portsmouth, New Hampshire

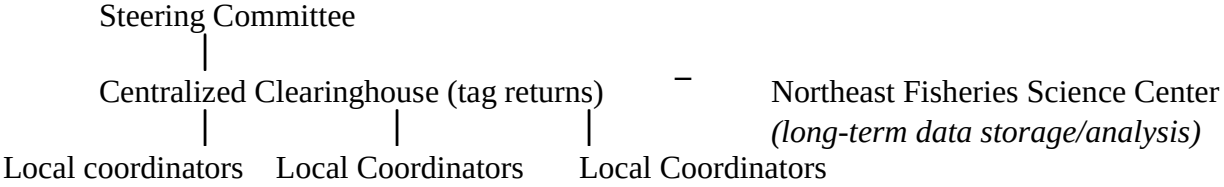
Attendees
Ted Ames, Stonington Fisheries Alliance
Joe Hunt, Fisheries and Oceans, Canada
Eric Goethel, New Hampshire Commercial Fisherman
Robert MacKinnon, Massachusetts Commercial Inshore Groundfish Assoc.
David Martins, School of Marine and Technological Sciences
Earl Meredith, National Marine Fisheries Service
Ben Neal, Island Institute
Dan Schick, National Marine Fisheries Service
Brian Smith, New Hampshire Fish and Game
Mark Terceiro, National Marine Fisheries Service
John Williamson, Fisheries Activist
Phil Yund, Gulf of Maine Aquarium

New England Aquarium Staff
Maggie Mooney-Seus, Manager
Jennifer Dianto, Senior Conservation Associate

John Williamson made an Announcement that a meeting will be held in early January among the Northeast Fisheries Science Center, states, and universities to look at collaborative research (specifically the overlap between the Cod-tagging Program and the Sentinel Fisheries Program).

Given current discussions by NEFMC and NMFS (NMFS) about how cod-tagging funds are to be dispersed, there was some discussion over the two options currently on the table: 1) RFP process and; 2) State/Federal Partnership to disperse funds. The majority of the group was in favor of an RFP process.

COD-TAGGING PROGRAM INFRASTRUCTURE



Identifying the local coordinators to implement the cod-tagging program and establishing the Clearinghouse for tag returns may involve two RFPs, one for administering the tagging program

and another for the Clearinghouse. This does not preclude one organization from submitting a proposal to take on both tasks.

I. Tag Dispersal

A. Local Coordinators

1. There should be local coordinators to maximize distribution of the tags and ensure representative sampling for scientific purposes. They will:
   a. Identify fishing vessels;
   b. Pay the boats;
   c. Administer training;
   d. Order and disseminate supplies;
   e. Conduct outreach and publicity campaign;
   f. Collect biological samples; and
   g. Maintain contact with Clearinghouse. (collect tags and then forward them to Clearinghouse or simply direct tag returns to the Clearinghouse).

2. Local Coordinator could be an individual or a local organization such as a state agency, NAMA, Island Institute, Massachusetts Fishermen's Partnership or a fisherman's Coop.
   a. It also was agreed that even if separate agencies implement the program at a local level, there must be consistency in tag dispersal, etc.
   b. Through the RFP process, local groups/coordinators will be identified to administer the program.

B. Tagging Locations

1. A concern was raised about how to implement an RFP process to ensure that all appropriate regions participate in the program to help maintain scientific integrity of the program.
   a. Strawman for Tag Dispersal:
      i. Maine Coast, 8K
      ii. New Hampshire/Jeffrey's Ledge, 7K
      iii. Cape Cod, Nantucket Shoals and Southern New England 10K
      iv. U.S. Central Gulf of Maine, 4.5K
      v. Canadian Bay of Fundy, 4K
      vi. Canadian Nova Scotian Shelf, 4K
      vii. U.S. Georges Bank, 8K
      viii. Canadian Georges Bank, 4.5K

It was agreed that this would provide a template for the town meeting discussions. Fishermen would then be asked how, when, where to best cover these respective areas with a given number of tags.

   b. Another strawman that was discussed was to divide areas based on where fishermen are living.
      i. Maine Coast (East and West of Penobscot Bay)
      ii. New Hampshire

iii. Massachusetts North Shore and Inner Cape
iv. Massachusetts South Shore and Outer Cape
v. Southern New England

Depending on the response from the fishing community to the first strawman, this may or may not be introduced during the Town Meeting.

C. Training Program

1. It was agreed that a comprehensive training program will be required for all participants in the program.

2. Should have a training session for the program investigators (PIs) that is part of an orientation to discuss not just how to tag but the bigger picture and the role of the Clearinghouse, etc. This also will provide PIs with expertise in tagging to share their knowledge with others.

3. Preference of the Task Force was that the trainer travel to or is based in various areas rather than hold a training session for local fishermen in a centralized location.

D. Vessel Compensation

1. A question was raised about how to do deal with the compensation issue versus various sized vessels.

2. Some thought that it might be best to leave the issue of how to compensate up to local coordinators. But a point was raised that this could create inequities among participants and flaws in the data collected because participation may be higher in areas that compensate, etc.

3. One suggestion was made that identifying participants should entail the following protocol: Interested fishermen would be required to sign-up for the program. There would be some screening to ensure individuals did not have any violations. Interested fishermen also must be willing to work in partnership with scientists. Second, they would be required to go through a formal training program to ensure consistency in tag application. Third, their name would be entered into some sort of lottery system or they would be called upon based on a rotational list. Fourth, they would be paid a flat rate for their participation or a sliding scale based on vessel size.

4. It was suggested that may want to avoid rewarding fisherman on a per tag basis to get a higher number of tags in the water as we do not want to create an incentive for people to throw tags overboard just to collect money.

5. It also was pointed out that the non-monetary rewards should be stressed when pitching the program (e.g., opportunity to work in partnership with scientists and have access to immediate information based on tag returns).

It was agreed that the question of compensation should be discussed further at town meetings as no consensus was reached on this issue.

E. Publicity

1. May discuss further at next Task Force meeting, although only to provide guidance to local coordinators. Much of their approach may need to be based on particulars of local situation.

F. Tagging Program Guidelines

1. Equipment to be used
   a. T-bar tag

2. Size of fish to be tagged
   a. Spawning fish
   b. Pre-recruits (15 inches are big enough to survive tagging) *Opportunistically*
      i. There was agreement that it may be worth learning more about pre-recruits but that this would require some regulatory hurdles (mesh size exemptions) so it may be best to focus energies initially on spawning fish (size range in literature/stock assessment, Mark Terceiro to provide by next Task Force meeting). May be worth tagging juvenile fish opportunistically that are caught through regular fishing practices. Also may be worth in areas of high juvenile concentration to do some dedicated tagging studies on pre-recruits.
      ii. It was agreed that it was appropriate to ask fishermen during Town Meetings where concentrations of small fish occur.

3. Refined Hypothesis
   a. "There are regional, yearly, different movements of cod within the Gulf of Maine."
   b. It was agreed that it might be appropriate to have individuals submitting RFPs develop more specific hypotheses, that contribute to a greater understanding of cod movement patterns (namely the broader hypothesis).

4. Information that must be collected by Fishermen:
   a. Location
   b. Length
   c. Tag

d. Biological samples. Perhaps, the local coordinator can prompt fishermen for more information and pick up the biological samples. The communication between the local coordinator and the Clearinghouse has to flow both ways. Some tags will go directly to the Clearinghouse. But some fishermen will give the tags to the coordinator. The coordinator can then forward the tags to the Clearinghouse. Those who call the Clearinghouse directly with tag information can be asked if they still have the fish. If so, the Clearinghouse can call the local coordinator to pick up the fish.

II. Centralized Clearinghouse for Tag Returns

The group reviewed and revised Clearinghouse Criteria developed at the previous meeting. Main point of discussion was that the Clearinghouse should serve as a coordinating body for dealing with tag returns. It should not have regulatory responsibilities.

A. Revised Criteria for Clearinghouse Selection

1. Must be identifiable as an independent entity specific to this cod-tagging program, at least initially. The organization's role may be expanded in the future to incorporate other specie's tagging efforts depending on its initial success with cod-tagging program.
   a. If the Clearinghouse was established as a separate entity but still could take advantage of some of the existing infrastructure of an established organization such as SMAST, UNH, Manomet, or Island Institute, etc., this may enable maximization of available federal monies.

2. Should be a neutral third party to house, manage and conduct some of the analysis of the data. (e.g., tag should not identify specific group but rather simply read, "Gulf of Maine Cooperative Cod-tagging Program" with corresponding return phone number.)

3. Must serve as coordinator as it may be that research methodologies must vary by area/gear type to maximize the dispersal and return of tags.

4. Should have access to community-based groups for building support for the program and disseminating program results (e.g., fishing cooperatives, NAMA, Bay of Fundy Marine Resources Center, Massachusetts Fishermen's Partnership and Center for Community Based Management, etc.).

5. Must have capability to make the data readily accessible to all interested parties in a timely manner. Should have credentials to develop a web page and ability to establish links with existing mechanisms for data dissemination.
   a. Need to have plan in place for how data are going to be distributed.

6. Should have capability to mount historic data and make data compatible with collected data.

7. Should have adequate storage space for samples (freezer) and some analytical capabilities.

8. Should have ability to coordinate International effort or collaborate with Canadian counterpart, given that tag returns and dispersal likely will occur in Canadian waters.

B. Clearinghouse Staffing

1. Should be relatively small in scale. But, at minimum, include database personnel (designer/manager to handle daily inputs and maintain webpage) and outreach person to coordinate with local groups who are administering the program.

C. Role of Clearinghouse

1. Tag collection, short-term data storage and data dissemination for cod-tagging program through various means identified at November Task Force meeting. In long-term may expand role to include other species.

2. Reward distribution for tag and fish returns.

3. Maintain a catalogue of current tagging projects and programs. Recognizing that with other tagging programs and projects ongoing in the Gulf of Maine/Georges Bank region, the Clearinghouse could also serve function to direct callers, who find tags for other programs and projects, to appropriate implementing agency.
   a. A word of caution was raised that if track record for data dissemination for other projects and programs is not good, Clearinghouse runs risk of negative association by providing this service.

D. Funding for Clearinghouse

1. A suggestion was made and widely accepted by group that the Clearinghouse should be funded by hard money to ensure that it will endure over the long-term.

2. It also was agreed that in the long-term, additional funding may be provided by various agencies conducting cod and other tagging studies. They would pay a fee to Clearinghouse to handle data and information collection and dissemination. It was recognized that some data and information would have to be kept proprietary to maximize participation.

3. It was agreed that the program would have to generate enough publicity and ultimately generate higher tag returns for its own effort to attract

interest and support from other tagging projects. A point was raised that it has to be a cheap enough investment so that various organizations' contributions were low enough to achieve economies of scale.

E. Marketing for Clearinghouse

1. Two marketing efforts go on in a cod-tagging program. First, we must get the tags into the water and have enough people distributing them. Second, and often the most neglected part of this kind of program, is to focus on increasing tag returns. The latter can be accomplished by increasing the amount of data collected and improving the turnaround time for data and information back to the researcher and the fisherman. The Clearinghouse can link the person returning the tag to the organization and database that generated that tag initially. The fisherman returning the tag needs then to be informed about the database and receive information about it so he knows what he just contributed to.

F. Clearinghouse Steering Committee

1. In order to build trust, a Steering Committee consisting of various groups involved in tagging programs would be established and include adequate representation from the following:
   a. State agencies;
   b. Provincial agencies,
   c. Federal agencies;
   d. Academic institutions; and
   e. Fishing organizations, etc.

2. Purpose
   a. To provide input on how, where and when the data should be managed. This would not be an oversight body for cod-tagging program and future efforts, but merely a body to look at data management.

3. Should have a fixed chair and rotating seats.

4. Frequency of meetings
   a. Could meet once or twice a year to talk about Clearinghouse effectiveness in data dissemination and set goals for Clearinghouse.

G. Publicity

1. All permit holders should get a notice explaining why they need to send in tags.

(Publicity to be discussed more at last Task Force meeting)

III. Role of Existing Governmental Agencies (NMFS/Northeast Fisheries Science Center) and other organizations.

A. The Clearinghouse would immediately make available data collected through the cod-tagging program (respecting proprietary rights) to any interested party, including federal and state agencies. There also would be a need to store and analyze data over the long-term. The Northeast Fisheries Science Center may be the most appropriate body to perform the latter function as it has both technical capability and longevity.

B. If the RFP process is followed then NMFS will likely provide assistance with day-to-day program management. A government employee (program officer) likely will be assigned to oversee daily program management and consider needed modifications to ensure terms of contract are being met (e.g., should there be more tags distributed on Jeffrey's Ledge, etc.).

C. State agencies, fishing organizations and academic institutions may be involved in a number of ways, such as serving on the Clearinghouse Steering Committee or possibly as a co-PI on a grant proposal to implement the cod-tagging program.

IV. Long-term Monitoring Program

A. Recognizing that the current cod-tagging program may have a limited duration, it is important to set expectations of what can be accomplished through it accordingly. It likely will provide a snapshot of existing conditions, which are dynamic. As a result, there is a need for long-term monitoring or a process to identify changes in the ecosystem and identify spin-off projects/programs from this one.

V. Cod-tagging Program Long-term Funding

A. Given that once a tagging program is up and running the operating expenses are relatively small, it is possible that the fishing industry could absorb the costs of maintaining the program in the long-term.

Questions to be raised during Town Meetings with Fishing Community in January

- Can you identify patterns of movement that are of local interest and prioritize;
- How many cod do they think they could tag in a day;
- How much do they think they should be compensated;
- What capture method should be used in that town;
- Who is going to tag the cod on the vessel (scientist or fishermen?);
- Does there needs to be dedicated trips;
- What different gear types could be involved;
- What local groups might want to get involved;
- When is a good time to tag; and
- Who is interested in participating in the program.

A suggestion was made that it might be appropriate to approach those devastated areas with the message that you are trying to understand what happened to the fish. Also emphasize the income potential. In addition, make it clear that we are looking for various fisheries to participate and that this is not restricted to just cod fishermen.

Appendix 9: Task Force Meeting Summary IV

Meeting Summary
February 26, 2001
Urban Forestry Center
Portsmouth, New Hampshire

Attendees:
Ted Ames, Stonington Fisheries Alliance
Nick Anderson, National Marine Fisheries Service
Dan Aparo, Massachusetts Commercial Fisherman
David Arnold, Massachusetts Commercial Fisherman
Vincent Balzano, Maine Commercial Fisherman
Vito Calomo, Gloucester Fisheries Commission
Thomas Casamassa, Maine Commercial Fisherman
Donald Clark, Department of Fisheries and Oceans
Thomas Currier, Massachusetts Division of Marine Fisheries
Fred Dauphinee, South Shore Lobstermen's Association
Kevin Friedland, University of Massachusetts, Amherst
David Gallagher, Maine Fisherman
Chris Glass, Manomet Center for Conservation Sciences
David Goethel, New Hampshire Commercial Fisherman
Charlie Good, Massachusetts Commercial Fisherman
Lou Goodreau, New England Fishery Management Council
Julie Herndon, Northwest Atlantic Marine Alliance
Joseph Hunt, Department of Fisheries and Oceans
Kevin Kelly, Maine Department of Marine Resources
Peter Kendall, New Hampshire Commercial Fisherman
Robert MacKinnon, Massachusetts Bay Inshore Commercial Groundfish Association
David Martins, SMAST
Craig Mavrikis, Maine Commercial Fisherman
Carla Morin, Northwest Atlantic Marine Alliance
Robert Morowski, Maine Commercial Fisherman
Greg Morris, Manomet Center for Conservation Sciences
Benjamin Neal, Island Institute
Paul Parker, Cape Cod Commercial Hook Fishermen's Association
Kelly Penney, Maine Commercial Fisherman
Richard Syphers, Massachusetts Commercial Fisherman
Mark Terceiro, National Marine Fisheries Service
Tim Tower, Maine Fisherman
John Williamson, Fisheries Activist
Phil Yund, Gulf of Maine Aquarium Development Corporation/University of Maine

New England Aquarium Staff
Maggie Mooney-Seus, Manager
Jennifer Dianto, Senior Conservation Associate

Town Meeting Highlights

M. Mooney-Seus presented a review of Town Meeting results.

The group discussed the fishing community input on cod migrations. During the presentation, one Task Force member who is a fisherman stated that he has been involved in a long-term tagging study. He tags fish on Jeffreys Ledge and the flats. He said in the winter these fish tend to be caught off Georges Bank and in the spring some of them are found off Franklin's Swell. He said that all his tagging work is done from March through November. Another Task Force member added that based on his research, the northwestern Gulf of Maine historically was a critical spawning area.

In addition, the group further explored the value of having a tagging program and how it will aid in creating a positive public image of fishermen.

One participant raised the question of whether cod-tagging was a wise use of taxpayer's monies. He felt that given that cod will be rebuilt in five years, perhaps the money should be allocated for other research, which may be more of a priority. He questioned a government scientist about whether we do not already have a good idea about codfish movements.

The government scientist responded that we do have a good idea about fish movements from past studies. The question is whether anything has changed. Are the exchange rates significantly different today than they were when those studies were conducted?

Another fisherman urged that a broad scale program could reveal quite a bit of information such as the relationship between inshore and offshore stocks -- something we know very little about. There are areas where trawl surveys do not go. These are the areas we need to learn more about.

There was some discussion about the results of this tagging program being used to affect allocation. One participant urged that people needed to get past the allocation issue and move on to collect better information because no one is really happy with current management measures. He urged that cod is a good starting place because there is not enough money to look at all species and it is the most contentious. He urged that fishermen needed to do this, to be part of the answer and that no one would know the solution until the program is up and running.

Another audience member said that a further value of the tagging program is to complement assessments.

It was added that tagging programs could help identify really critical habitats and in the future -- maybe appropriately pinpoint Marine Protected Areas. It can help us broaden our definition of habitat and how we better manage our impacts.

Another Task Force member argued that part of the reason fishermen are in the mess they are in now is because the assessment strategy needs to be based on system-wide components. Right now the contributions of the inshore areas are being ignored. Tagging programs will let scientists know how fish are behaving and determine the critical phases of these movements.

It was further echoed that understanding fish movements is critical. For instance, if fish are spawning on Georges Bank and they move off the bank and are still being fished then

management measures enacted only on Georges Bank will not be effective. Similarly, if we have management measures in a given place but the fish are not there, what is the point?

The Facilitator and several Task Force members intervened stating that there had been enough debating the merits of a tagging program. They felt that the Task Force had been assembled with one charge, to make recommendations for designing a cod-tagging program, and since there was still a lot of work to be done it was best to move forward.

The group then turned to a discussion about refining the hypothesis and the importance of gathering information from closed areas. After some deliberation they came up with the following as the primary objective for the overarching large-scale conventional tagging program:

"Are there multiple cod stocks throughout New England and southern Canadian waters?"

One Task Force member urged that a lot came out of the Town Meetings in terms of local questions that also should be explored through tagging and that there may be a need to consider them further using electronic tags in some of these areas. He asked that the report reflect this.

Another participant maintained that tagging in Canadian waters was extremely important to the success of this program. He went as far as to suggest that some monies be allocated to Canadian fishermen for tagging in Canadian waters.

It was suggested that in order to obtain meaningful results with an anticipated 10 percent return rate, a minimum of 2,000 tags must be deployed in any one area. Another participant urged that the number should be higher between 5,000 to 10,000 tags per area. He felt that it was important to target pre-spawning and spawning aggregations during November to May as had been proposed by the Task Force during past discussions.

The Task Force prepared a list of proposed tagging sites within the broader geographic areas of Georges Bank, Gulf of Maine, Southern New England and Coastal waters. They included:

Georges Bank	Great South Channel
Massachusetts Bay	Cape Cod Bay
Stellwagen Bank	Jeffreys Ledge
Fippennies	Cashes Ledge
Platts	Ipswich Bay
Nantucket Shoals/Lightship	Off Chatham
Franklins Swell	Coxes Ledge
Sheepscot River	Penobscot Bay
Casco Bay	Mt Desert Rock
Passamaquoddy Bay	Grand Manan Channel
Mouth of the Bay of Fundy	Browns Bank

A recommendation was made that during the RFP process, it might be good to keep the Task Force involved to provide continuity.

There was a discussion about whether to tag other fish opportunistically as part of this program. While there was some support for this expressed at Town Meetings and by some members of the Task Force, others on the Task Force felt that in order for tagging studies to be scientifically valid they should be tailored to individual species. For instance, flatfish generally are more vulnerable so special handling techniques may have to be employed to enhance their survival

rates. However, another scientist pointed out that for species such as halibut and barn-door skate there is so little information now that any new information collected through opportunistic tagging would be beneficial.

The group discussed a minimum duration for the program and concluded that the recommendation should be for a five-year program.

Commercial Fishing Industry Letter

A letter was discussed that was signed by several fishermen stating concerns and recommended criteria that should be met to ensure a successful cod-tagging program. These criteria included: 1) data must reside with a neutral non-government entity for a minimum of five years before any data collected from this program are used in policy development; 2) there be tagging consistency and that only scientists on dedicated trips be allowed to tag fish; 3) an analysis must be conducted comparing those tags from dedicated trips and returned by fishermen with those captured by scientists to ensure that the data sets are the same; 4) dedicated and paid tagging trips will be used to maximize the number of fish tagged; 5) the program must be long-term with assurances of long-term funding commitments; 6) prior to implementation, the program design must define where, when and how many fish to tag; and 7) tagging programs should be designed for all New England stocks.

Some of these criteria have already been identified by the Task Force including: 1) a neutral, non-government entity be established for housing and disseminating data over the short-term (e.g. The Centralized Clearinghouse); 2) tagging be done primarily on dedicated, paid trips; and 3) that the program be long-term in scope with the ultimate goal of expanding the effort to include tagging of other species. It also is providing guidance on where, when and how many fish to tag.

There was some discussion about whether or not to have observers onboard. A few participants felt that either a scientist or a graduate student would be an asset for at least the initial trips until everyone gets up to speed on the tagging process. Others felt that fishermen also could be trained to serve as trainers. Ultimately, the Task Force maintained that the majority of the tagging should be undertaken by trained fishermen. The intent of this program is to foster working relationships between fishermen and scientists and to provide supplemental income to fishermen and a formal mechanism for them to contribute to scientific knowledge. In addition, the tagging procedure is fairly straightforward and will require limited training to master. However, the Task Force still recommended that all individuals interested in tagging undergo basic training to ensure tagging consistency.

There was some discussion about having scientists conduct a small-scale tagging study to coincide with the fishing industry tagging study to serve as a control data set. A concern was raised by several Task Force members that this would undermine the fishermen's efforts, creating a perception that the fishermen's data are not scientifically credible.

The Task Force also discussed the point raised in the letter about a recommendation coming from the Task Force to withhold distribution of data for a given period of time. The majority of Task Force members concurred that given that the Task Force's charge was to define a scientifically credible research program, it was not appropriate for this group to make recommendations with management implications. So, it did not recommend that data be held for

any set duration before being used in management decisions. A further point was made by one scientist that in rare instances extremely relevant information can be derived from a single fish movement. In addition, since management decisions must be based on "the best available science," any data collected from this program would have to undergo significant peer review by the Stock Assessment Review Committee (SARC) as well as the proposed Clearinghouse Steering Committee before it was considered by fishery managers.

One member of the Chatham community raised the point that very few fisherman from the Cape had been participating in Task Force discussions. He added that a Task Force meeting should have been held on the Cape. It was stated that since people were coming from Canada, Downeast Maine and western Massachusetts for these Task Force meetings, most meetings were held in Portsmouth to try to limit driving time for all participants. However, it was widely recognized that participation from the Cape had been limited to date and there was a shared concern that fishermen's interests were not being well represented in the discussions. It was reiterated that attempts had been made to involve fishermen from the Cape. Invitations were issued for all Task Force meetings. A Town Meeting had been in Chatham and another in New Bedford and there was good representation from the fishing community at both meetings. In addition, one-on-one interviews were conducted with a few Southern New England fisherman to incorporate their concerns and ideas and identify potential tagging locations in Southern New England waters.

Everyone agreed that it was critical to get all fishing communities onboard to participate in this tagging program. A statement was made that Massachusetts had led the way to get money for collaborative research and there was an opportunity here to gather better information so that more informed management decisions could be made. It was urged that fishermen need to show the government that they can collect good information.

Clearinghouse

The group discussed the role of National Marine Fisheries Service (NMFS) and determined that it would be appropriate for NMFS to house data for the long-term.

They also talked about confidentially and who would have access to data first. It was widely recognized that there are clear advantages to scientists who participate in this program, such as: 1) access to a wide range of regional data that may aid them in their specific research projects; 2) assistance with timely information dissemination to the fishing community regarding individual tag returns; 3) assistance with administering a comprehensive reward scheme; and 4) assistance with raising the visibility of their respective project and the potential for a higher tag return rate because they would be part of a widely publicized, broader-scale effort.

Still there was some concern among scientists about proprietary information and ensuring the integrity of their own studies. A few scientists voiced an opinion during the last Task Force meeting that local project coordinators (e.g., scientists and fishermen) should have access to the data before they are sent to the Clearinghouse. Typically results from scientific studies are distributed to the project scientists first as a matter of protocol for immediate analysis.

Another scientist suggested that there are likely to be more returns if all the data are returned to one location. The Clearinghouse could immediately turn around the data on the tag to the fisherman to provide incentive. He felt that should not pose a problem for researchers as the information on returns is only good if we know where the release came from.

The Task Force did not reach consensus on this point of discussion.

There also was quite a bit of debate about whether the Task Force should recommend that a minimum timeframe be established before data can be used in management decisions.

Others felt that to make such a recommendation was unreasonable. One scientist argued that on occasion you can get very significant information from a single fish movement pattern so it was not appropriate for the group to make any such recommendation.

Others urged that the data would have to undergo a very lengthy review process via the SARC before data could be used. The Clearinghouse Steering Committee also would have to review the data on an annual basis.

One fisherman urged that people from his community probably would not get onboard unless some guarantees were made that short-term data would not be used against them.

Another fisherman stated that you will not see significant enough data for three years out so this is a mute point.

On the advice of one Task Force member, it was agreed that the charge of this group was to design a research program not make recommendations that would have management implications so no such recommendation was made for withholding the data.

Publicity

Everyone agreed that there was a need to maximize publicity for the program. The need for publicity is often overlooked in scientific research.

A recommendation was made that a local advertising agency be approached to design a PR campaign for the program on a pro-bono basis.

Outreach materials should be developed, local press releases issued and paid ads run in trade publications.

It also was suggested that in order to get long-term support, you need national publicity.

Another point was made that it is equally important from a PR standpoint for project managers to know how to respond to negative publicity.

A suggestion was made to more readily utilize existing mechanisms for communication (e.g., NMFS public affairs office). However, it was agreed that in order to maximize PR opportunities and public perception of this as a collaborative program fishermen and scientists should jointly issue all press statements.

Appendix 10: Town Meeting Results

Highlights of Cod-Tagging Program Design "Town Meetings"

- Broad-based support for learning more about the effectiveness of the Closed Areas. Interest from several communities to do more intensive study of cod movements in and out of areas using acoustic tags, some genetic studies and habitat studies. Specific questions raised: Do the closed areas benefit recruitment? Are the areas enhancing spawning? Are fish migrating out of the areas? What is the stock dynamics? Are there multiple age classes represented in the areas? What is the relationship of fish to their habitat?

- Almost unanimous support for dedicated research trips with compensation to fishing vessels under 60 feet being $1500 a day. There was some support for encouraging participation of lobster fishing industry and recreational (charter boats) to gather data from offshore and closed areas and more year round data on juveniles. The idea of covering expenses for lobster boats willing to tag juveniles during regular commercial fishing operations and provide charter boats with some sort of a "fee" for tagging fish was discussed in some communities as an important complementary effort to dedicated research trips. Using the industry-based Surveys in this effort was also suggested in a couple of instances.

- Concern raised about maintaining data integrity. Fear by some fishermen that self-interest may taint survey results. Also fear prevailed with some fishing interests that data collected could hurt them if there was cheating and if management decisions were made based on a limited amount of data. A suggestion was made that data must be long -term and demonstrate some meaningful trends before management decisions are made. In addition, there also was support for having some sort of observer program or having only scientists or trained personnel tag fish to ensure that data collected are scientifically credible.

- Widespread agreement that adults (legal size and up) should be tagged and that pre-recruits should be tagged opportunistically.

- Agreement that all gear types should participate, albeit fishing effort should be modified to enhance survivability of fish. Widespread support for having all mobile gear equipped with a holding tank and short tows (about 10 minutes), gillnetters should engage in short sets (4-6 hours) and also have a holding tank. Some limited jigging also may be appropriate on these trips. Lobster boats should have opportunity to undergo dedicated trips too, however in these situations may be best to jig for fish rather than sample via traps to capture adults. Thought that best time to tag was during colder weather/winter months to enhance fish survivability.

- Consensus that fishermen could tag 100 fish in a day.

- A number of fishermen felt that one to two days a month was the most they could participate in this program. There was a looming question of whether Research Days would be counted against Days at Sea. In many areas fishermen did not want Research

Days to count against Days at Sea. However, in Ellsworth where the groundfish fishery is very small, there was interest in having Research Days count so that fishermen could retain their groundfishing permit.

- There was support for a reward program (dual lottery). Some support for small incentives like hats. Most agreed that information and a thank you letter were key incentives.

- Almost all who attended meetings expressed interest in participating in tagging effort.

- Some suggestions made to enhance information about bycatch and discard survival rates (e.g., tag healthy fish above 400 pound trip limit, tag species perceived as endangered like barn-door skate, tag other groundfish that may be viewed as overfished in future fishery management plan amendments).

- Consensus that there must be guarantees that research will not be delayed by lengthy processes to obtain experimental fishing permits. A suggestion was made that if fishermen were on dedicated trips may be able to avoid having to secure experimental fishing permits because this is a research program.

    - One idea brought up in New Bedford is that parties interested in doing the tagging should secure letters of support from various groups including environmental community as part of their funding proposals in an effort to help expedite the permit process.

    - A recommendation should come from the Cod-tagging Task Force that experimental fishing permits (if needed) be granted at time of project funding to avoid hold ups in conducting the research.

- Total agreement that if this is going to be a viable program must sample all areas (including closed areas and Canadian waters).

- Representation from the offshore industry was not apparent at any of the Town Meetings. The turnout for Rhode Island meeting was not good and there was limited interest in the program despite multiple attempts to reach out to fishing and management communities. Initially there was considerable opposition in the town of Chatham. But Chatham fishermen held a follow up meeting and have expressed some interest in participating in the program if certain conditions can be met in the program implementation. They, along with some fishing interests from other communities, have since provided additional input and recommendations for the Task Force to consider.

- It appears that best time for tagging is November through May to avoid thermocline and capture post-spawning fish and juvenile fish aggregations.

TOWN MEETING SUMMARIES

All meetings facilitated by Marjorie Mooney-Seus, minutes recorded by Jennifer Dianto, New England Aquarium

PORTLAND, MAINE

January 4, 2001
Casco Bay Lines Ferry Terminal

(Supplemental information, which appears in italics, was collected via telephone.)

Attendees:
Nick Anderson, National Marine Fisheries Service
Vincent Balzano, Saco, Maine
Julene Britt, reporter, WGME News 13
Earl Meredith, National Marine Fisheries Service
Jon Graboscotini, Morehead City, North Carolina
Sheri Henze, Island Institute
John Higgins, Pemaquid, Maine
Carla Morin, Northwest Atlantic Marine Alliance
Ben Neal, Island Institute
Craig Pendleton, Northwest Atlantic Marine Alliance
Don Perkins, Gulf of Maine Aquarium
Kelly Penney, Saco, Maine
Jim Salisbury, Portland, Maine
William Train, Portland, Maine
Bob Tetrault, Portland, Maine
John Williamson, Fisheries Activist
Phil Yund, University of Maine

Interviewees:
Procter Wells, Phippsburg, Maine

Patterns of Movement of Local interest

There was a genuine interest in learning the justification for the 42º 20' line. Some felt that there needed to be a clearer hypothesis along the lines of the following:

"Are there one, two or multiple stocks of cod in the Northwest Atlantic?"

A question was raised about whether Browns Bank, the Northern edge of Georges Bank, the Eastern and Western Gulf of Maine, Nova Scotia and the Bay of Fundy constituted discrete stocks. This program shed some light on the answer to this question.

Along these same lines, one fisherman questioned why they never catch medium-sized fish in Rhode Island, why fishermen catch a mix of fish in Ipswich Bay and why off of Maine (in 30 to 40 fathoms of water) they catch all whale cod. He felt that the tagging program should more closely explain size distribution.

There was consensus that the tagging program must be comprehensive (from Nantucket shoals to Sable Island and the Grand Banks) with full participation from the Canadians.

It would be worthwhile to do some sort of study off of Downeast Maine to look at the relationship between the inshore and the offshore areas. Some people believe that there is a resident population of cod in this area because they look different, namely, cod in this area have dark bellies.

Another suggestion was to do a small-scale study to look at the relationship between the Kettlebottom and Monhegan Island.

There was agreement that in order to conduct an effective study, fishermen must have access to closed areas (like Jeffreys Ledge, the Rolling closure areas, etc.) to tag fish and collect some returns. This also would help validate the closure of these areas in the first place.

It would be interesting to do some tagging on the Fingers on Jeffreys Ledge, on Platts Bank and Seguin Island towards Monhegan Island.

When is a good time to tag fish?

A majority felt that the program should be year round. It was suggested that tagging start in May around the Great South Channel and move up the coast throughout the summer months when cod are abundant. A comment was made that otter trawls are an effective way to get at cod in the winter months. It also was stated that due to the scarcity of fish in the area, it was important to tag year round. *One fisherman stated that he believed fish came into local waters from the Southwest in the spring and mix with smaller stocks along the coast.*

Some felt that it was important to tag not just spawning fish, but fish aggregations as well. It was suggested that June through August might be a good time to tag to get at these aggregations. But a word of caution was raised that water temperatures and other environmental conditions may lead to year-by-year variations in the timing of aggregations.

It was urged that if you want to catch codfish in the offshore areas during the winter months, it might be easier to catch them because their metabolism slows down. However, they are much more vulnerable and their survivability may be lower. It was suggested that it might be best to tag them in less than 50 fathoms of water to enhance survivability.

What size fish should be captured?

Many of the fishermen present felt that all sized fish should be tagged not just spawning fish. It was suggested that shrimp, lobster boats and modified fishing gear could help tag and collect data, particularly on juveniles. Some thought that it would be important to learn if there are different movement patterns among different age groups and when the different breaks occur between age groups. One fisherman stated that to catch seven to eight inch fish, you have to use a liner or a shrimp cod end.

It also was stressed that different gear types catch different sized fish. The benefit of having mobile gear involved is that they are able to sample everything in an area. Therefore, they should be allowed access to closed areas to tag fish as well.

It might be worth doing some tagging on juveniles. They seem to be more prevalent in Sheepscot River and Casco Bay region in spring (April to June). It also would be interesting to tag some other species like winter flounder/black back. The black back population does not seem to be coming back despite limiting fishing pressure on it.

Should there be dedicated or non-dedicated trips and who should do the tagging?

There was general agreement that trips should be dedicated, not part of standard commercial fishing operations. *Two fishermen spoken to outside the meetings were in agreement that dedicated trips were the best way to conduct the program. It further was suggested that coding fish in such a way that they could be detected with a scanner at Portland Fish Exchange if missed during commercial fishing operations, was a good idea.*

A question was raised about if tagging were to happen during a commercial fishing trip, how would you deal with the trip limit issue. Inability to answer this question, led to more widespread support within the group for dedicated verses non-dedicated trips.

For the most part, since fishermen largely supported the idea of a dedicated trip, fishermen themselves were interested in doing the tagging rather than having a scientist onboard.

What should the length of the tow be? How can we enhance survivability?

All felt that tows should be short (about 10 minutes in duration) in shoal waters to ensure survival of codfish. It also was agreed that boats should be equipped with holding tanks, particularly in the case of draggers, to keep fish alive before they are tagged and assess well being after being tagged. One fisherman added that the only problem with short tows is that you will not tire the fish out. This may impact how many fish you are able to catch and tag.

A point was made that it would be important to do a corresponding survivability study of released fish as part of this program. In particular, it would be important to assess survival rates of fish caught in various gear types (hook-and-line, jigging, longlining, gillnetting and otter trawl, etc.). One participant added that if using a jigging machine you could set the retrieval rate automatically to enhance survival rates (ensure fish do not get the bends) and ensure consistency in the capture method. He even went as far as to say that rather than using commercial fishing vessels, it may be better to just jig for fish. This will improve survival rates and ensure a consistent approach to entire tagging effort.

Who should participate?

It was suggested that using shrimp nets, lobster traps and longlining vessels might result in higher cod survival rates. But it was pointed out that these gear types are size selective. Otter trawls sample everything that is there. One suggestion was made that perhaps otter trawl gear should be modified to enhance survivability. But concern over limiting participation, if fishermen had to modify their gear, led to the suggestion that towing at much slower than a typical fishing operation could improve survival rates and not compress cod in the nets. So, in essence most agreed that all gear types could participate in the program if they modified their fishing method accordingly to enhance survivability of cod.

One fisherman urged that water temperature plays a critical role in where codfish are and are not. Several participants supported the idea that at least 20 percent of tags should be archival to get more detailed information including water temperature.

A point was raised that in order to enhance participation if fishermen are participating on a dedicated trip, the trip should not count against days at sea. In addition, an account should be set up so that fishermen can be paid for their time promptly (e.g., four to five days). This individual said that he had participated in the Juvenile Groundfish survey and that fishermen should be aware of the fact that fishing at slower speeds puts a lot of wear and tear on their fishing vessels (on hydraulic cooler in particular).

How many fish can fishermen handle in a day?

It depends on the size of the crew.

There was some agreement that fishermen should not be asked to collect too much information. Recording the length of the fish would be doable but weighing each one might be too time consuming. It was discussed that fishermen should collect basic weight, size and sex information when tagging fish.

Another fisherman added that it also depends on how thick the fish are in the area that you are fishing. He felt that the amount of information collected should be limited to a portion (a sample) of fish caught, perhaps information should only be collected on a certain size class (e.g. 24").

What is fair compensation for fishermen on a dedicated trip?

A few participants stressed that it was important to factor in fishermen's competency when considering compensation.

Everyone agreed that there should be a sliding scale depending on vessel size.

One fisherman's wife interviewed on the telephone prior to the meeting stated that for her husband's vessel, reasonable compensation would have to be in the $1,500 to $3,000 range. A few fishermen polled outside the meeting agreed that for smaller boats $1,500 a day would be adequate.

How do we enhance rate of tag returns?

One participant cautioned that a great deal of thought must go into devising an effective strategy for enhancing tag returns to ensure the success of this program. To avoid bias, the returns must be widely dispersed both spatially and temporally.

There was some discussion about collaborating with the Industry-based Surveys to monitor closed areas and improve return rates.

It was stressed that a clearly visible 1-800 number should be apparent on all tags so fishermen could make a call right from their boat if they wanted to report the tag information.

It was suggested that the tag should be coded so it could not be manipulated and that the reward should be more than the cost of the fish to make it worthwhile for fishermen to report the information.

The lottery was seen as a good idea, but it provided no instant gratification. One suggestion was that rather than a monetary reward that one-day at sea be the prize for the lottery.

One fishermen pointed out that most fishermen who have been attending these meetings are supportive of the program and may be willing to tag and return tags for little or no incentive. However, there are many fishermen out there who might need a greater incentive to return tags. He suggested that perhaps a fee per tag should be paid -- something on the order of $20 to $50 per tag would get people to turn in tags.

Most agreed that getting information immediately back about the recovered tag and fish movement was critical to the success of the program. A few even went as far as to say they would participate without any reward provided that they received timely information when they returned tags. Many felt that a website would suffice for getting information back to fishermen. Some felt that this would provide an easily accessible means for fishing organizations to access, download and disseminate information to their members.

Everyone agreed that if scientists wanted whole fish returned, then the market price should be paid for the fish.

There was a thought that since everyone has to go to market, tags could be turned in there.

It was urged that an effort should be made to educate the recreational community because they will be capturing tags and we want them to turn them in.

Who is interested in participating?

Everyone in the room showed an interest in participating once the program was up and running.

POINT JUDITH, RHODE ISLAND
January 8, 2001
Finbacks Restaurant

(Additional information was collected via telephone as much of the Fleet was out at sea when this meeting occurred and there was a snowstorm both of which hindered attendance)

Attendees:
Peter Wakeman, Pt. Judith, Rhode Island
Greg Lisi, Wakefield, Rhode Island
Robert Smith, Charlestown, Rhode Island

Interviewees:
Dean Pesante, Tucker Town, Rhode Island
Ralph Boragine, Rhode Island Commercial Fishermen's Association (also provided feedback from fishermen who attended weekly Association meeting in February)
Frank Blount, Frances Fleet, Charter Boat Operator

Patterns of Movement of Local interest

Since there really are not any closed areas near this fishery, there seemed to be limited interest in gathering information from closed areas.

When is a good time to tag fish?

The lobster fishermen present said that they tend to catch juveniles from November through March in the near shore areas and year round on Georges Bank (Little Georges). One fisherman said that he generally catches about 300 pounds of lobster in a given day and always sees cod in his traps, particularly around November and December. Out of a 50-pot trawl he may see three cod in a trawl, average about four to five pounds, occasionally as high as 10 pounds.

The charter boats catch sublegals year round from November through mid-June.

November through March was thought to be a good time to catch cod. The belief is that the cod come into the area, south of Block Island and east, from the Northeast. Fish are generally caught from Block Island, southeast to Coxes Ledge and southwest to No Mans and Martha's Vineyard.

Charter Boat operators see fish year round in Great South Channel.

What size fish should be captured?

They felt that all sizes should be targeted in the program to get a more comprehensive assessment of cod movements and distribution at different life history stages.

Should there be dedicated or non-dedicated trips and who should do the tagging?

They felt that you could do a combination of things, lobster fishermen could tag during normal commercial operations or could do a dedicated trip. The head boats could do as part of their normal course of business. *Fishermen polled at Rhode Island Commercial Fishermen's Association weekly meeting unanimously supported idea of dedicated research trip. A few fishermen interviewed over the phone echoed this opinion.*

What should the length of the tow be? How can we enhance survivability?

One of the lobstermen present said that he had worked in other fisheries over his lifetime and felt that we should be careful about how fast cod are hauled up. One point was made that for a scuba diver to surface he should come up at a rate of about a foot a second. So for a 120-foot haul, this would translate into about two minutes to bring up the net in a single haul. The length of the tows should be short, but so should the speed at which nets are brought up. One suggestion was made that at least a portion of the monies for the program might be allocated to jigging operations because they have the ability to set the speed at which a haul is brought up. This would help ensure consistency in tagging method and improve cod survival rates.

All agreed that the focus of the cod-tagging effort should be between 14 and 20 fathoms and not much deeper to enhance survival rates. All thought that lobster fishermen could be help in the tagging effort because they already have holding tanks onboard. They felt that other gear types should be required to have holding tanks onboard to enhance survivability.

All agreed that as a compliment to this program, it would be good to do some survivability studies in New England waters with various gear types.

A fisherman interviewed outside of this meeting said that tows should be short and in less than 15 to 20 fathoms to enhance survivorship. He said that he is a gillnetter and gillnetters who participate should make short sets (four to six hours). He also felt that if this was a dedicated trip that gillnetters could also do some jigging to enhance survivability. His boat is equipped with a slush tank that he could easily convert should he need to monitor condition of the fish. Many guys could do the same thing. He added that there are four gillnetters operating out of Point Judith and a few more guys operating out of Sakonnet. Most of the guys in Point Judith area are lobstermen and a few draggers.

Who should participate?

One of the three lobster fishermen present said he generally fishes off of Georges Bank. He said that he would not have a problem doing this as part of his normal fishing trip if some means of compensation could be worked out (e.g., Covering his trip expenses? Allowing him to keep some fish?). He said that he would be able to record a rough estimate of length and weight of each fish too. All three fishermen present felt that using clam bellies was good bait for attracting cod if goal was to increase the number of codfish caught in lobster traps.

Those present felt that all gear types should participate including lobster fishermen and head boats. One fisherman felt that if head boats were paid "a tip" or a fee of about $200 to $300 a day or were awarded one fish per boat, they might be willing to return tags. He said he knows that around this area, the head boats tend to catch a lot of little fish.

A fisherman interviewed said that he thought everyone should have a chance to participate. He felt that gillnetters would be able to collect more cod than draggers in the region though because the draggers could not get into hard bottom areas where cod are and gillnetters fish.

How many fish can fishermen handle in a day?

One fisherman pointed out that to try to tag 100 fish in most areas of Southern New England might be difficult. He felt that the Great South Channel would provide the best location to tag this volume of fish. On a good day, most Southern New England draggers haul in about 200 to 300 pounds a day.

What is a fair compensation for fishermen on a dedicated trip?

If lobster fishermen were to be compensated to participate in the program, a suggestion was made that the fee paid be around $1,500 a day, which is what the cable patrol pays lobstermen to help them.

They thought that it was appropriate to have fishermen do the tagging, but occasionally have a researcher onboard to spot check and make sure everyone was tagging correctly.

A representative of the Charter Boat Industry said that he thought that because of the low numbers of fish in the region, it may be more appropriate to pay charter boats a fee per fish, possibly $15 a fish.

How do we enhance rate of tag returns?

There was a belief that all gear types want information. This is incentive enough.
A fisherman interviewed said that hats are a nice idea. A lottery is an even better idea ($1,000 a year sounded reasonable). He also felt that information was a real incentive. "These days the more information we can get back quickly the better." He also supported the idea of the Clearinghouse.

Who is interested in participating?

Two out of the three guys present said that he would be interested in participating. The other said that he is semi-retired and generally does not see many cod in his traps so it probably would not be worthwhile to have him participate.

All those interviewed on the telephone expressed an interest in participating in the program.

NEW BEDFORD, MASSACHUSETTS
January 9, 2001
School for Marine Sciences and Technology (SMAST)

Attendees:
Rodney Avila, New Bedford, Massachusetts
Ed Baker, New Bedford, Massachusetts
David Bergeron, Massachusetts Fishermen's Partnership
Chris Glass, Manomet Center for Conservation Sciences
Pat Kavanagh, Falmouth, Massachusetts
Jim Kendall, New Bedford, Massachusetts
Dave Lincoln, Massachusetts Fishermen's Partnership
Robert Lane, Mashpee, Massachusetts
Bob MacKinnon, Marshfield, Massachusetts
Ana Marcalo, New Bedford, Massachusetts
Dave Martins, SMAST
Gregg Morris, Manomet Center for Conservation Sciences
Andrew Porter, Orleans, Massachusetts
Antonio Pereira, New Bedford, Massachusetts
Ed Rohmer, Orleans, Massachusetts
Chip Ryther, East Falmouth, Massachusetts
Jodie York, SMAST
Manny Vinagre, New Bedford, Massachusetts

Patterns of Movement of Local interest

Fishermen felt that the modified hypothesis discussed in Portland was on track.

To learn more about cod movement and answer this question, tagging should take place on Georges Bank, Gulf of Maine and Nantucket Shoals because several fishermen present felt that cod in these areas look different.

A suggestion was made that since most of the current tagging efforts are in shallow water, it would be worthwhile to have a small-scale project in deeper water, especially to assess cod survival rates. This only should be done as part of a dedicated trip.

Another suggestion made was that a small-scale project should be implemented to look at survivability of bycatch in regular commercial operations to assess survival rates of cod after release. There is a belief among fishermen that survival rates are much higher than NMFS and others currently assume in the assessment. There would have to be some incentive to offset associated costs of fishing to make it worthwhile for fishermen to participate in this study.

Some felt that it also would be important to use smaller mesh to target juveniles so they could be tagged and a better understanding of their movements could be gained.

There was consensus that tagging also should be done in closed areas (including rolling closures). The thought was that it should be commercial boats not recreational boats doing the tagging. Vessels should be able to secure needed permits to do the work and be clearly identified (perhaps with a flag of some sort) so the coast guard knows that they are participating in a

scientific study. In addition, there was no apparent opposition to putting observers onboard the vessels that are participating in the study.

One suggestion was made that a subset of the overall tagging program should look at tagging other species that co-occur with cod, particularly species that are considered vulnerable like barn-door skate, etc. to gain further insight about the status of these other species.

There was some support for conducting a finer-scale tagging study with electronic tags and possibly some bottom-grab samples to answer questions about fish habitat, particularly in the closed areas.

An additional suggestion was to conduct a fine-scale study to examine movement between Nantucket Shoals and Georges Bank in relation to water temperature.

Another suggestion was that a smaller-scale study using acoustic tags and listening stations (set about a mile and a half a part) be used to assess movement of cod in and out of closed areas.

It generally was agreed that a recommendation should come from the Task Force that when contracts are awarded to implement this program, an experimental fishing permit be granted along with the award so that the work can begin immediately and so that the program is not delayed (whether that be gaining access to closed areas or experimenting with gear modifications etc.) It also was suggested that it might be worthwhile to assemble a peer group including scientists, fishermen, environmentalists, etc. to review the program and prepare a letter of support for the program to help with securing the appropriate experimental fishing permits in a more timely fashion.

When is a good time to tag fish?

On the shoals the fish are gone after January and do not return until spring. In the Gulf of Maine, they are present year round. On Georges Bank, they are there in the winter and spawning takes place January to March while spawning occurs later in spring in shoal waters.

One fisherman currently involved in the SMAST tagging program said that his experience has been that fish survive better if they are tagged during colder months. Their survival decreases if they have to be brought through the thermocline. A suggestion was made to tag fish from October 1 through May 1 to avoid the problem of the thermocline.

A suggestion was made to look at the Massachusetts Trawl Survey and gear selectivity /survivability studies by Arne Carr to get a better handle on survival rates. It also was suggested to look at literature regarding deflating swim bladder experiments on the West Coast. One scientist present pointed out that deflating the swim bladder could be done using a hypodermic needle but that such a procedure would require training before others could attempt it.

It was agreed that if you were interested in tagging juvenile fish a good time of year was December, January, and February when large aggregations are found in Massachusetts Bay.

Most fishermen in the room said they were unsure about where fish spawn, possibly in shoal waters, but they saw reasonable numbers of whale cod in the spring in and around Cape Cod

Bay. It also was pointed out that the state of Massachusetts' reports that there are large concentrations of spawners occurring in five to nine fathoms. (Arnie Howe).

What size fish should be captured?

Large fish, especially on Georges Bank. But the group also saw value in tagging juveniles.

A few fishermen and scientists who are currently involved in tagging said that in the last few weeks they have tagged a lot of juveniles in the 15 to 19 inches size range in shoal waters.

Should there be dedicated or non-dedicated trips and who should do the tagging?

There was a consensus that the program should focus on dedicated trips. There was some support for having observers onboard to ensure that people do not throw tags overboard if it is not in their best interest to report them.

What should the length of the tow be? How can we enhance survivability?

Many present felt that the length of tows should be no more than ten minutes, and fish should be put directly into totes. At present, the SMAST study is occurring mostly in about 15 to 19 fathoms. Bob MacKinnon worked in waters as deep as 42 fathoms off Scituate and had at least one recapture of a fish so far. But he felt that the only reason for his success and survival of this particular tagged fish was because it was tagged in cold water.

Most of the current tagging effort by SMAST is in shallow water and there is not that much concern about swim bladder expansion and reduced survival rates. However, fish survival rates will likely decrease in deeper water.

Who should participate?

It was agreed that all gear types should be allowed to participate. However, a point was raised that captains must not be the only ones trained or aware of the program. An effort should be undertaken to educate vessel crews and recognize those individuals who actually bring in the tag return. In other words, the person who actually gets the tag return, not just the vessel captain, should get a thank you letter for returning tag information.

How many fish can fishermen handle in a day?

One fisherman said that there should not be a rush to tag the most fish possible -- that to be effective and enhance survival of codfish would have to be handled carefully. To make sure things are properly handled, measured, etc. 200 to 250 fish a trip is a lot to handle. 75 to 100 is about average. 300 is possible on a really calm day, but should not be the standard required.

Most fishermen supported the idea put on the table by those who were currently tagging that the cold weather months were probably the best time for tagging. They felt that they could realistically tag a few days a month and still operate viable commercial businesses the rest of the month.

One scientist present echoed the concern that the goal of the program should not be to put large numbers of tags in the water and that it was better to ensure that fish live after tagging. It is

important not to flood an area with tags, but to put enough out over a large time period on a regular basis (two year period, etc.) to get strong scientific information back regarding movement and stock discreteness. Therefore, dedicated trips tagging 1,500 fish are not only unrealistic, but it would not yield strong scientific information (compromising survivability). We should not just look at a year long program either. It should be a long-term, multi-year program and should include all fish sizes, including the juvenile population.

What is a fair compensation for fishermen on a dedicated trip?

There was some support for paying small fishing vessels around $1,500 in compensation. For large boats the thought was that it should at least be doubled. An estimate of around $3,600 was given as a reasonable amount to cover the daily costs including food and fuel for a large boat with a crew of five. Obviously if you are using large scallop vessels with crews of 13 or more, the pay would have to be even higher.

How do we enhance rate of tag returns?

Several people commented that if there was a reasonable amount of publicity for people returning the tags, this might provide a clear incentive for people to return tags.

An example was given that the Canadian scallop project sent fishermen letters containing information about where, when and how far individual fish traveled when they turned in tags. Another in the room said that they had found that a personalized, hand-written letter was very effective and appreciated by fishermen.

It was agreed that a lottery to reward both the individual who tagged the fish and the individual who returned the tag would be most effective -- that way whoever wins shares with the person who sets the tag. This will improve fish handling when fish are tagged because there is further incentive to make sure the fish are healthy before they are put back into the water. In addition, getting the word out via magazines, trade papers, press, posters, etc. was widely supported by the group. One example that might be worth looking into is the west coast Halibut tagging program. They have nice publications, a lottery reward system (dual reward system) and give away hats or t-shirts to individual fishermen. Another example is the brown king crab fishery in Alaska, where fishermen are allowed to keep a percentage of the catch.

Another suggestion was to reward the vessel with the most returns as further incentive to maximize returns.

The importance of training people was discussed, with the emphasis placed on returning only healthy fish to the water.

There also was some support for the Clearinghouse concept as an incentive for greater fishing industry participation.

Who is interested in participating?

Based on a show of hands, many in the room seemed interested in participating in the program when it was implemented.

CHATHAM, MASSACHUSETTS
January 10, 2001
Eldredge Public Library

Attendees:
Debbie Connors, Chatham, Massachusetts
Gregory Connors, Chatham, Massachusetts
Shareen Davis, Monomoy Trap Company
Rosemarie Denn, North Chatham, Massachusetts
Jamie Eldredge, West Chatham, Massachusetts
Morgan Eldredge, Chatham, Massachusetts
Jim Frottreiz, Wellfleet, Massachusetts
Chris Glass, Manomet Center for Conservation Sciences
Raymond Kane, West Chatham
Mark Leach, Orleans, Massachusetts
Bob MacKinnon, Marshfield, Massachusetts
Greg Morris, Manomet Center for Conservation Sciences
Steve Murawski, National Marine Fisheries Service
Cecil Newcomb, Orleans, Massachusetts
Paul Parker, Cape Cod Commercial Hook Fishermen's Association
Gabe Parker, Chatham, Massachusetts
Andrew Porter, Orleans, Massachusetts
Mark Simonitsch, Chatham, Massachusetts
Peter Taylor, Chatham, Massachusetts
John Welch, Chatham, Massachusetts
Azure Westwood, Cape Cod Commercial Hook Fishermen's Association

There was quite a bit of apprehension about cod-tagging in Chatham. Most present urged that data must be long-term and demonstrate some meaningful trends before management decisions are made. In addition, there also was support for having some sort of observer program or having only scientists or trained personnel tag fish to ensure that data collected are scientifically credible. A subsequent meeting was held among local fishermen to prepare recommendations for the Task Force. The results of that follow-up meeting will be provided shortly.

Patterns of Movement of Local interest

There was a suggestion to look at fish movement in and out of Area 1 to see what is happening in the area. Is it a source or is it a sink? Does it benefit recruitment? There was a belief that recruits are moving west onto Georges Bank, across the Great South Channel and up. One scientist pointed out that with conservation on Georges Bank, there now is a subsidy of fish going into the Gulf of Maine, so we are starting to see more relative recruitment in the Gulf of Maine. One suggestion was made to tag juveniles in Area 1 and see where they go.

When is a good time to tag fish?

Not Answered.

What size fish should be captured?

Not Answered.

Should there be dedicated or non-dedicated trips and who should do the tagging?

Most present felt that tagging should be done as part of a dedicated trip and not part of regular commercial operations.

What should the length of the tow be? How can we enhance survivability?

Not Answered.

Who should participate?

Not Answered.

How many fish can fishermen handle in a day?

Not Answered.

What is a fair compensation for fishermen on a dedicated trip?

One fisherman at the meeting suggested that $1,500 a day was a reasonable fee for day boats.

How do we enhance tag rate of tag returns?

A concern was raised over how the data collected through this program was going to be used. One fear was that as data was collected these data would be used to shape management decisions. It was suggested that a region-wide panel be assembled, consisting of various interest groups, to evaluate preliminary data. It was felt that enough data had to be collected over a number of years so that seasonal shifts in abundance or movement patterns could be appropriately understood before further management decisions were made. This group also should be able to evaluate the effectiveness of the tagging program to determine if there are any holes in the tagging data and adjustments need to be made to better address these holes. The group felt that a minimum return rate should be required (e.g., 10 percent) before management decisions were altered for cod.

One suggestion was made that local groups could hang on to tag returns for at least three years until enough tags had been collected to yield accurate and complete information about cod movement patterns and distribution.

Who is interested in participating?

Not Answered.

GLOUCESTER, MASSACHUSETTS

January 11, 2001
Gloucester Fishermen and Families Assistance Center

Attendees:
Nick Anderson, National Marine Fisheries Service
Dan Aparo, Rockport, Massachusetts
Ed Boynton, Gloucester, Massachusetts
Gaetano Brancaleone, Gloucester, Massachusetts
Vito Calomo, Gloucester, Massachusetts
Paul Cohan, Gloucester, Massachusetts
Bill Cunningham, Gloucester, Massachusetts
Jerry Falasia, Hamilton, Massachusetts
Bill Fisher, Gloucester, Massachusetts
Antonio Giacalone, Gloucester, Massachusetts
Madeleine Hall Arber, MIT Sea Grant
Tom Hill, Rockport, Massachusetts
John Hogan, Rockport, Massachusetts
John Ketchopulos, Rockport, Massachusetts
John Knowlton, Rockport Massachusetts
Tim MacDonald, Gloucester, Massachusetts
Bob MacKinnon, Scituate, Massachusetts
David C. Marciano, Beverly, Massachusetts
Earl Meredith, National Marine Fisheries Service
Emily Monosson, Montague, Massachusetts
Robert Morris, Rockport, Massachusetts
William Muniz, Gloucester, Massachusetts
Paul Niedzwiecki, Schraffts Center
Dennis O'Connell, Rockport, Massachusetts
Joseph Orlando, Gloucester, Massachusetts
Giuseppe Palazzolo, Gloucester, Massachusetts
Eleni Papadakis, Gloucester, Massachusetts
Judy Pederson, MIT Sea Grant
Tom Porter, Salem, Massachusetts
Antonio Randazzo, Gloucester, Massachusetts
Russell Sherman, Gloucester, Massachusetts
Paul Theriault, Rockport, Massachusetts
Paul Vitale, Gloucester, Massachusetts
Leo Vitale, Gloucester, Massachusetts
Albert Williams, Swampscott, Massachusetts
Lou Williams, Swampscott, Massachusetts
John Williamson, Fisheries Activist

Patterns of Movement of Local interest

One fisherman said that he believes there is evidence that Georges Bank fish grow slower than fish in the inshore areas. He said that they used to find that fish off Cape Cod were double the size of fish from Georges Bank. He would like to use tagging studies to verify differences between Georges Bank and inshore areas.

One suggestion was made to conduct a small-scale study to look at length, size and catch frequencies of cod from various gear types.

Another suggestion was made that fishermen should tag all the cod they catch above and beyond their 400-pound trip limit to assess survival rates and get a clearer picture of what is being discarded.

There was broad-based support for a study to assess movement to and from closed areas. There also was a desire to learn more about abundance within closed areas. All agreed that access to closed areas was critical to the program's success. Key areas for tagging should be in the shoal areas of Jeffreys Ledge, on Cashes Ledge, Fippennies Ledge and Stellwagen Bank. It would be worthwhile to do some sort of acoustic tagging study to track fish movements inside and outside these areas. An additional point made was that since much of the shoal water is in closed areas and survival of released fish is higher if they are taken from shoal waters then access to closed areas is further justified.

When is a good time to tag fish?

The majority felt that the best time to conduct research would be during the month of April, when fishermen have to tie up their vessels. Also, there was some general support for tagging fish during the cold weather months of December, January, February and March because fish tend to be lethargic (metabolism is slower) and they are easier to catch. There was a belief that fish would have the best chance of survival if caught in 40 to 50 fathoms or less, and under a short tow.

There was agreement that the more inshore you could get, the better chance you had of getting juveniles and enhancing their survival. It was thought that during April around the Middle Bank might be a good time and place to target juveniles. However, it also was pointed out that during the month of April, in 20 fathoms, fishermen tend to catch a range of sizes anywhere from 8 to 36 inches.

Most fishermen did not want to sacrifice fishing opportunities to participate in the tagging program, so they supported that most tagging be done during the closures.

It was suggested that it is a good idea to stay away from areas where cod are feeding because they tend to have lower survival rates when they are brought to the surface.

What size fish should be captured?

All sizes should be targeted as part of this study.

A few fishermen currently involved in tagging in this area said that they have tagged fish ranging in size from eight to thirty-six inches. Another fisherman said that he catches small fish using six and a half inch mesh in his gillnets along the shore. There was some consensus that when using regulated fishing gear, the catch of juvenile fish was low. Nevertheless, juveniles should be tagged when caught. Most present worried that to wait to acquire experimental fishing permits could slow the start of the program. Therefore, juveniles should be tagged opportunistically.

Should there be dedicated or non-dedicated trips and who should do the tagging?

Most of the fishermen present supported the idea of the research being done on a dedicated trip rather than during commercial fishing operations.

What should the length of the tow be? How can we enhance survivability?

There was some consensus that a short tow was appropriate, between 10 and 20 minutes for draggers.

There was almost universal agreement that every vessel should be equipped with some sort of live well, especially mobile gear.

There is a belief that smaller fish have higher survival rates when captured in static commercial fishing gear.

Who should participate?

All gear types should be allowed to participate. While most seemed to support the idea that since this was at least in part to provide relief money, priority should be given to the commercial fishing industry, in particular, active commercial fishermen, to participate in the program. There was some concern about allowing latent permit holders a chance to participate. A few in the room supported the idea for the development of criteria for qualifying vessels. Paul Cohan on behalf of the Massachusetts Fishermen's Alliance said they would take the lead in drafting some criteria for the Task Force to review at its next meeting. Only a few fishermen felt that charter boats should be allowed into closed areas to help retrieve tags.

Most felt that regular commercial fishermen participating in the program should fly some sort of flag to clearly identify themselves to the Coast Guard as participants in the tagging program when they enter a closed area.

Fishermen seemed interested in doing the tagging themselves and felt that there should be workshops to train fishermen in the tagging technique. Some were not opposed to having observers or scientists onboard vessels as well, but there was a concern over the cost of additional insurance.

It was thought that lobster fishermen and hook-and-line fishermen might be able to target smaller fish in near shore areas, within eight miles from shore. One lobsterman pointed out that for every 1,500 to 3,000 pounds of lobster he lands in shoal waters, about one-quarter the catch is cod, most of which is juvenile.

At least a few in the room supported the idea of having party boats access closed areas to help with the tagging and return effort.

How many fish can fishermen handle in a day?

If fishermen were allowed access to closed areas, they might be able to handle as many as 300 to 400 fish in a given day if on a dedicated trip. But as a rule of thumb 100 fish in a day is a more realistic goal for a captain with a sternman.

What is fair compensation for fishermen on a dedicated trip?

Some fishermen said that reward money was not the issue, getting good information was of most value. But the majority seemed in favor of some form of compensation – at minimum, compensation for fuel and expenses. One fisherman shared that he burns 100 gallons of fuel in a 12 to 14 hour day on his 50-foot vessel. There seemed to be some agreement that if a fee were paid to fishermen for services rendered, between $1,500 to 3,000 for vessels up to 50 feet in size would be reasonable. Large vessels should receive about $3,000 a day.

How do we enhance rate of tag returns?

Everyone liked the idea of a clearinghouse for data/returns, particularly the idea that it would be a neutral entity.

Most agreed that fishermen who turned in tags should get some sort of report back, with a nice thank you note. One fisherman said he had returned a tag for a current program and received something that looked like a diploma. He thought that was a nice touch. There was some support for telephone follow-up, but most agreed that regular mail would be the best way to reach people.

There also was support for turning in a small percentage tags along with the entire fish to answer additional research questions.

There was limited discussion about honesty in reporting. It was emphasized that there just has to be a certain level of trust that fishermen are genuinely interested in getting better information and will do the right thing. One fisherman suggested that a percentage of tagging should be done with acoustic tags to overcome misreporting problems. Another suggestion was that observers be randomly placed on boats to monitor tagging effort.

Who is interested in participating?

Most everyone present said they were interested in participating in the program once it got off the ground. One fisherman said that he was sick of meetings and talking about tagging, he just wanted to get started.

SCITUATE, MASSACHUSETTS
January 15, 2001
Veterans of Foreign Wars Meeting Hall

Attendees:
Brainerd Ames, Scituate, Massachusetts
David Ames, Scituate, Massachusetts
Ed Barrett, Green Harbor, Massachusetts
John Barrett, Norwell, Massachusetts
Steven Bergman, Marshfield, Massachusetts
Phil Brazao, Brant Rock, Massachusetts
Lisa Campenella, Patriot Ledger
Paul Unangst, Marshfield, Massachusetts
Fred Dauphinee, Scituate, Massachusetts
Jonathan Dauphinee, Scituate, Massachusetts
Barry Ehrstein (Strider), Hull, Massachusetts
Stephen Ericson, Town River Yacht Club
Ron Gustafson, Scituate, Massachusetts
Chuck Harris, Scituate, Massachusetts
John Haviland, Green Harbor, Massachusetts
Jim Keding, Marshfield, Massachusetts
Lou Gainor, WATD Radio
Scott MacKinnon, Marshfield, Massachusetts
Robert MacKinnon, Marshfield, Massachusetts
Andrew and Laurie Mannix, Brant Rock, Massachusetts
Frank Mirarchi, Scituate, Massachusetts
David Pallotta, Scituate, Massachusetts
LeRoy Rofe, Scituate, Massachusetts
Kevin Shea, Scituate, Massachusetts
John Shea, Scituate, Massachusetts
Brian Smith, Hull, Massachusetts

Patterns of Movement of Local interest

There was universal agreement that access to the closed areas for tagging and retrieving tags was critical. A common feeling was held that many fishermen are under pressure to make money when areas are open and would be reluctant to participate and sacrifice valuable fishing time during open seasons. It also was suggested that a smaller study using archival or acoustic tags would be worthwhile to learn more about the benefits of the closed areas to date (e.g., Are fish migrating out of the areas? Is their enhanced spawning? What are the stock dynamics? Are there multiple age classes represented in the closed areas?) Some fishermen who were involved in satellite tagging for tuna said they thought that work had gleaned some interesting results, but agreed that it might be cost prohibitive to use this technology for cod-tagging under the present funding scenario. A suggestion also was made to utilize the Industry-based Surveys to access closed areas.

A member of the recreational fishing industry was present and said that he felt there would be many recreational fishermen interested in participating in the program. Another commercial fisherman who approached the facilitator after the meeting echoed the importance of making

sure that recreational fishermen are at least educated about the program and encouraged to turn in tags.

One fisherman expressed his belief that for the first time in 20 years he is seeing spawning aggregations back in areas that were reported to be key spawning areas when Bigelow and Shroader conducted their field research. He thought the tagging program should be designed to help verify this belief – namely that fish move up through the Great South Channel, up into Massachusetts and Ipswich Bays and then disperse throughout the winter months.

It also was suggested that it would be worthwhile to tag other species opportunistically, particularly dogfish which are abundant and the 22 species that will be covered under Amendment 13. One fisherman urged that it was important to get ahead of the game and learn more about the mortality rates of the species viewed as in the worst shape from this group of 22 species. He felt a small-scale study in conjunction with this cod-tagging effort could lead to more effective management of these other species.

Many agreed that Stellwagen Bank is a good place to tag fish in January. At least some of the individuals who supported this idea were currently involved in the SMAST tagging effort and had good experiences tagging in this area in January, 2001.

When is a good time to tag fish?

Most agreed that it is best to tag fish during colder months, when water temperature is equal to air temperature and when surface and bottom temperatures are more closely aligned.

It also was suggested that since lobster fishermen fish year round, they could certainly help augment the data collection during the warmer months. One lobster fisherman present said that he would be willing to tag cod for just the cost of fuel as part of his regular fishing activities for lobster. He said he tended to catch cod just and inch or two below minimum size. Other lobstermen present said that they caught a variety of size ranges of cod in their traps. One said he caught a cod measuring about 25 inches on a recent trip. Another lobster fisherman from Hull, Massachusetts said that he fishes 200 traps in about 5 to 20 meters of water and tends to catch an average of eight to nine cod on each trip, year round in his traps. He added that he sees a lot of worms in the fish.

One suggestion was made that it would be a good idea to try to talk to some key fishermen in each port about fishing hot spots as a means for more clearly identifying key tagging areas.

What size fish should be captured?

There was widespread agreement that all sizes should be tagged as part of this study.

A point was made that tagging juveniles would be a worthwhile effort in near shore areas, particularly since these areas really are not captured in current government research surveys.

Should there be dedicated or non-dedicated trips and who should do the tagging?

There was consensus that dedicated trips were a good way to go, but if lobster fishermen wanted to tag fish as part of their regular lobster fishing activities that should be allowed too.

What should the length of the tow be? How can we enhance survivability?

There was agreement that mobile gear should be required to have a holding tank onboard their vessels to enhance survivability. Some others believed that because hook-and-line, and jigging etc. handled fish one-by-one, a holding tank might not be necessary for these gear types.

Fishermen must be adequately trained in the tagging procedure. One suggestion was made that perhaps the Industry-based Surveys could participate in the training effort. There also should be an issuance of an experimental fishing permit once fishermen were trained so as not to hinder research.

Who should participate?

All gear types: gillnetters, jiggers, etc.

One suggestion was made that the whiting fishery should be encouraged to participate because they have been fishing with smaller mesh.

How many fish can fishermen handle in a day?

A few fishermen who are currently tagging cod felt that at least two people should be onboard to tag fish and record data. They felt that even on a dedicated trip it was a lot of work for one individual. There was some support for the notion that 100 fish could be tagged in a day.

What is a fair compensation for fishermen on a dedicated trip?

Most agreed that it was best to do tagging as part of a dedicated trip. One fisherman who is currently tagging said that he found it difficult to pair tagging with fishing. He urged that to offset the reduced income if fishermen were to tag fish instead of catch them, they should have an exempted fishing permit to do dedicated tagging.

There was wide support for paying $1,500 a day to vessels ranging in size from 30 to 60 feet (the day boats). But a few fishermen said that they did not think a reward was necessary, they were just interested in seeing the data. One even stated that to receive some small token of appreciation such as a hat for turning in a tag was almost an insult. But most agreed that if a sizable annual lottery were held, they would be interested (a figure of about $1,000 was discussed).

How do we enhance rate of tag returns?

It was urged by some present that all groups tagging must use the same tags, so there is less chance that certain areas may discard tags and undermine the program if they believe it is not in their best interest to turn them in.

It was urged that open communication should be encouraged among participants. There should be regular meetings to discuss program results and build support for the program.

The group agreed that getting information back in a timely fashion was the key to the entire program. Some thought that a website would be a good way to get a look at all of the data as they are collected.

Who is interested in participating?

All in room said they would be willing to participate. This included a mix of hook-and-line, lobstermen, and mobile gear. Fishermen present wanted to get the program started as early as possible. If the money was not going to be available until June, they felt that perhaps the program could be multi-phased and kick off with the lobster industry in June and then bring in cod fisheries in the winter months when the water temperature is more conducive to effective cod-tagging (colder water).

PORTSMOUTH, NEW HAMPSHIRE
January 17, 2001
Urban Forestry Center

Attendees:
Erik Anderson, Portsmouth, New Hampshire
Carl Bouchard, Exeter, New Hampshire
Bob Campbell, Yankee Fishermen's Cooperative
Dan Dunbar, Swampscott, Massachusetts
David Gallagher, Kennebunkport, Maine
David Goethel, Hampton, New Hampshire
Lou Goodreau, New England Fishery Management Council
Peter Kendall, Rye, New Hampshire
Bob MacKinnon, Marshfield, Massachusetts
Craig Mavrikis, Eliot, Maine
Kelly Penney, Saco, Maine
Brian Smith, New Hampshire Fish and Game
John Williamson, Fisheries Activist

(four fishermen joined the meeting but asked not to be included in this list)

Marc Stettner, recreational fisher, Portsmouth, New Hampshire provided additional written comment after the meeting.

Patterns of Movement of Local interest

Most people present felt that understanding the relationship between Georges Bank and Gulf of Maine cod would be a worthy study.

There was a concern raised that if the program was going to be successful, the program must have access to closed areas for tagging and recovering tags. A fisherman in the room pointed out that it might be worth doing some sentinel tagging during the month of February in Massachusetts Bay, but it would be important to get fishermen from other ports to do tagging in other areas at other times of the year so a clearer picture of cod distribution and movement patterns could be obtained.

There was a limited amount of discussion about tagging fish to learn more about bycatch survival rates. One fisherman expressed some concern about the validity of such a study given that in many instances fish may be left on the deck a long time before they are returned to sea so their survival rates would be lower.

There was some support for tagging fish on Middle Bank (Stellwagen Bank) year round.

When is a good time to tag fish?

All year round. But there is a widely held belief by those currently involved in tagging that survivability is lower in warmer months.

One fisherman said that large fish tend to congregate around wrecks in summer months. It might be worth doing some sort of study to learn more about fish behavior in relationship to these

areas. In particular, he said that there are a greater number of large fish on Middle Bank in 16 to 18 fathoms of water. While the smaller fish (year 1) can be found in the shoal water up to 20 fathoms (Massachusetts Bay) year round. He added that fish over 20 inches tend to be seasonal to New Hampshire waters and generally appear around March to July and to a lesser extent from Fall to early July. He added that where the fish are is really a gear issue. For instance, during the Western Gulf of Maine closures, there are a lot of fish in the Massachusetts Bay area because that is where the boats are fishing.

What size fish should be captured?

Everyone present felt that it was important to tag all sizes so more could be learned about various growth rates. There is a widely held belief that large fish migrate and small fish stay relatively sedentary.

Should there be dedicated or non-dedicated trips and who should do the tagging?

There was broad-based support for dedicated trips, but a few in the room felt that there should be opportunities for fishermen to participate during standard commercial fishing operations. Perhaps, each fisherman could be awarded 50 tags with his permit. To this point, a concern was raised about quality control in terms of tag insertion and fish survivability. If everyone got tags, everyone would have to have some kind of training. It was agreed that, at minimum, notices should go out to all permit holders alerting them of the program and encouraging them to turn in tags. And, if they were interested in getting directly involved in tagging, a number could be provided to them to learn more about the program.

A point was made that it was more important to ensure higher survivability rates than getting large numbers of tags in the water. If the goal is just to put a large number of tags into the water and only a few tags are recovered then, ultimately, that can skew the CPUE that is derived from the tagging program. In addition, it was pointed out that the goals of fishing and research are different; when fishing the goal is to haul back quickly to maximize the size of your catch, but in research you want to haul back slower to ensure that a greater number of fish survive to be tagged. It again was stressed that if you are going to tag, you must be trained and a dedicated trip is a good way to ensure quality control, consistency in tag application and hopefully enhanced survivability of released fish.

What should the length of the tow be? How can we enhance survivability?

A suggestion was made by one fisherman who is currently involved in tagging that the tow length should be about 15 minutes, in 30 fathoms or less of water. In addition, the fish should be brought up slowly through the water. In other words, the boat should be placed in an idle position, with just enough movement to keep a strain on the gear. When the net is pulled in, it should be keep loose, so the fish are not compressed and they can swim around freely at the back of the boat. The fish should then be put into a live tank, where the gills are aerated and the fish condition monitored before it is tagged and returned to the water.

It was felt that fish that are caught via handlines or hook-and-line should be handled for no more than 30 seconds (measured and tagged) before they were put back into the water. For gillnetters and draggers fish should be put into a live well for some period of time and their condition should be monitored before they are tagged and released. Similarly, if tagging is done as part of

standard commercial fishing operations, rather than on a dedicated trip, the fish should be put into a live well. After the set is complete, the condition of each fish should be assessed and only the fish in the best condition should be tagged and released.

Who should participate?

Most felt that everyone, all gear types, should be allowed to participate. A few suggested that the recreational community and charter boat industry would be important partners in this effort.

It was suggested by one member of the group that in areas closed to certain gear types only fishing gears that were permitted in the areas be allowed to tag fish so as not to undermine the effectiveness of existing management measures.

How many fish can fishermen handle in a day?

Some fishermen who were currently involved in tagging studies said that they could tag as much as 200 fish on a good day. But perhaps a more reasonable number would be 100 on a regular basis. *A member of the recreational community felt that if you were hook-and-line fishing, 25 to 50 would be a more reasonable target.*

There was considerable discussion about the data collection aspect of the program. It was agreed that it was not unreasonable to expect fishermen to collect information on where a fish was tagged, when and how big the fish was (at least length and a rough estimate of weight).

It also was suggested that permit holders should not only be aware of the program and advised to turn in tags, but also have a cod-tagging report on their boat that would be completed when they recovered a tag.

What is fair compensation for fishermen on a dedicated trip?

There was broad-based support for providing vessels, day boats that fish roughly 12 hours, under 50 feet with $1,500 in compensation for a day's work. This would cover boat, captain, crew, food, fuel (roughly 100-150 gallons a day) and equipment. There was some discussion about whether vessels could be contracted to work half days. All agreed that costs to get out on the grounds are the same, so there is no such thing as a half a day of work.

Most agreed that obviously a vessel (trip boat) that fishes Georges Bank, Browns Bank or the Hague Line and operates around the clock would have to be compensated more. Costs for these vessels can range from $2,500 to $8,000. Some thought that $3,000 seemed like a reasonable amount to pay these vessels.

There also was some discussion about performance. Some vessels are just more efficient at catching fish than others, how do you account for that? One suggestion was that the there should be some sort of bid process conducted through a local organization/coordinator to identify boats to participate in the program. This fisherman felt that it was important to look at performance and CPUE rates of various vessels so you would have a better idea of how many fish you could expect to tag as well as having some means for assessing fishing vessel performance. But a point also was raised that even in areas where fish numbers are low, you still want to tag there so you have a better understanding of fish movement overall. In other words, CPUE is only part of the equation. Again, it was argued that the numbers are less important than ensuring that fish are

properly handled and alive and well when they are put back into the water, so returns can be enhanced.

Several people in the room felt that an ideal situation would be to have, in addition to the crew, a scientist or a trained student or trained fisherman onboard all boats participating in the program. This person could have responsibility for recording data. But others felt that it is not rocket science to tag fish and the captain and crew could do the tagging and record information with the appropriate training. A suggestion was made that perhaps a percentage of the boats could have this third person onboard.

How do we enhance rate of tag returns?

It was suggested that the tags include a 1-800 number so fishermen could call in and report the tag number to the appropriate agency from their boats. In turn, each fisherman would like to receive a report of where the tag started and where the fish traveled along with a thank you note for turning in the tag. Two-way communication is critical.

One fisherman said that he had participated in the shark-tagging program (NMFS Narragansett Lab) and appreciated receiving a hat or a key chain when he recovered a tag. He said it also was nice to get regular communication. On a biannual basis he received a flyer, which listed the tags and recaptures, shark species caught and movement patterns. At minimum, the same level of information should be provided to fishermen through this program.

It was urged that in order to enhance tag returns, there must be a well thought out plan for getting the word out including but not limited to the following: outreach to the recreational community; notification to all commercial permit holders; newspaper articles in local, regional and Canadian newspapers; announcements on radio programs; articles and/or ads to increase participation and provide periodic progress reports in trade publications (e.g., National Fisherman, Commercial Fisheries News Fishermen's Voice, etc.); communications through local Fishermen's Cooperatives (e.g., mailings, posting of notices, word of mouth, etc.); weekly reminders to turn in tags on the weather Channels (NOAA weather box); and a quarterly or annual report highlighting program results for all participants and interested parties, etc.

There was some consensus after considerable discussion that tags should all be the same color to ensure that data are not skewed by areas, which may not want to turn in tags if they are concerned that the program may hurt them.

There was some support for just taking the number of the tag and letting the fish go, so more could be learned about individual fish movements. At the same, it was recognized that the opportunity for misreporting may be higher if tags are not turned in. A point also was made that if juveniles are tagged, results of this effort will not be apparent for a number of years until fish reach legal size.

There was quite a bit of discussion about the value of information. While some echoed concerns about the data being used against them, others stated how information had proven very beneficial to the scallop industry.

There was some discussion that the Task Force should provide some guidance about the percentage of tagged fish that should be put back into the water.

Several in the room said that accurate information really was more important to fishermen than a reward.

A point was raised that since tags may be at liberty for years after the duration of the program (cod can live up to 20 years or so), it was important to post a bond, clearly stating up front that the lottery program or reward program will run for XX number of years after which time you are no longer eligible for a reward.

There was strong support for setting up a steering committee to evaluate the effectiveness of the program, to assess how many tags are being distributed in various areas and if there are any gaps that must be dealt with in future tagging.

A member of the recreational community suggested that rather than putting fish in a holding tank, it might enhance survival if fish were put on ice before being tagged and put back into the water. He further added that to enhance tag returns, individuals should be paid $25 per fish.

Who is interested in participating?

Most in the room said they would be interested in tagging fish.

ELLSWORTH, MAINE
January 18, 2001
Holiday Inn

Robin Alden, Stonington Fisheries Alliance
Ted Ames, Stonington Fisheries Alliance
Dick Bridges, Stonington Fisheries Alliance, Sunset, Maine
Carol Bridges, Stonington Fisheries Alliance, Sunset, Maine
Richard Bubar, Stonington Fisheries Alliance
Jen Bubar, Stonington, Maine
Bill Crowe, Fishermen's Voice
John Higgins, Darling Marine Center
Alice Kellerman, Island Advantages
Kevin Kelly, Maine Department of Marine Resources
Michael Kirby, Downeast Foundation, Jonesport, Maine
Heidi Leighton, Cobscook Bay Resource Center, Eastport Maine
Bill Look, Beals Island, Maine
Scott McGuire, Sunset, Maine
Bruce Mc Innis, Cobscook Bay Fishermen's Association, Eastport, Maine
Earl Meredith, National Marine Fisheries Service
Ben Neal, Island Institute
Dennis Preston, Edmunds, Maine

Two other fishermen joined the meeting late, but did not sign the sign-in sheet.

Patterns of Movement of Local interest

One suggestion was made that it would be good to learn about localized movements of cod outside the 40-fathom line near Seal Island, about half way to the Bucksport Bridge. Fish here seem to stay in the area. It would be interesting to know whether these fish represent a resident population and, if not, where these fish come from and where they go.

There was general support for learning about whether Georges Bank and Gulf of Maine cod constitute one or more stocks. It was suggested that as a compliment to tagging some genetic studies should also be done as part of this program.

There is a belief that whales (cod) are coming into areas to spawn up and down the Maine coast. Some felt that the tagging study can shed some light on where these areas are.

One fisherman from the Eastport area said that he believes his fish move in and out of Canadian waters. He thought that it would be worthwhile to do some tagging between Passamaquoddy Bay, Campobello Island and Grand Manan. He said up until the 1970s this area supported an active handline fishery which now is gone.

Another recommended local study was to look at movement between fish from Mount Desert Rock east, back off shore and then westward into Penobscot Bay. Some believe there is evidence to suggest that there is a division within the Gulf of Maine, separate eastern and western stocks.

A second participant echoed the importance of a localized study in Penobscot Bay stating that big fish (two footers) are beginning to appear way up in the bay near the Long Island Depot. In the past, some of the main runs were in this area. It would be worth tagging fish inside and outside the area, as well as juveniles (even though information could not be collected from the latter animals for four or five years until they entered the fishery). The Island Institute has been conducting a long-term study on current patterns, surface temperature and water flow in the bay. However, there may be other ancillary studies worth considering to help assess whether this area constitutes a metapopulation. The Stonington Fisheries Alliance expressed interest in pursuing this idea further.

The waters around Vinal Haven seem to have more fish in them than they have had in years. A small-scale study in this area may be worthwhile as well. One fisherman pointed out that he thinks the habitat for juvenile fish has improved, there is more kelp around since the sea urchin population has declined.

When is a good time to tag fish?

If interested in tagging small fish, there are quite a few small fish in Cobscook Bay and in Passamaquoddy Bay. Generally lighter cod (fishermen believe represent a local population), which tend to move into the bay in May. The larger cod (migratory fish which are darker in color) come into the bay around the time of the full moon in June or July.

In the last three years, juveniles are generally found out to 40 fathoms (shoal waters), in the winter months. Some fishermen said that fish that come into near shore areas have reddish colored skin and the majority of them have worms in them. They are often caught in winter months in shrimp nets. One lobster fisherman added that if you are interested in tagging fish containing spawn, this is the time of year they catch them.

Many of the large fish have been thinned out along the shore, so fishermen must travel farther offshore to get at them.

If interested in catching adult cod around the shoreline, can catch fish ranging in size from 15 to 24 inches from May to June.

Another fisherman said that you could easily tag adult fish from summer into November and then again from early spring into late fall – pretty much year round. He felt that since the institution of the rolling closure, there has been an increase in the number of two and three year old fish on shore. This is the first time he has seen fish this size, this close in, since he was a kid.

Many felt that if you wanted to get a good picture of local cod movements, then some tagging must be conducted in closed areas (rolling closures too).

What size fish should be captured?

The group felt that all size fish should be captured. Most agreed that it would be just as important to tag young fish to see where they are, whether they stay in certain areas and at what age they start to move. One fisherman said, **"**Right now we see ripe fish. It would be nice to see that the smaller ones mature and end up in this group. No one knows much about the linkage between the egg and where these groups go to spawn. If we tag both groups (adults and juveniles) we will know more about this big gap."

Should there be dedicated or non-dedicated trips and who should do the tagging?

Most supported the idea of a dedicated trip.

There also was some support for tagging as part of regular fishing operations (beyond the 400 pound trip limit) to assess survivorship of discards. A suggestion was made that fish should be held in a live well for about 10 minutes. If the fish look okay, then they can be tagged and then released back into the water.

What should the length of the tow be? How can we enhance survivability?

All felt that it was imperative that a survivability study be conducted prior to the start of the tagging program (to assess survivability of cod in all gear types).

One participant said that he had heard of other studies where a thermometer was put into the fish as soon as it was caught to assess what temperature it should be kept at (in live well) before it was put back into the water.

Who should participate?

All gear types. Canadian fishermen too. A few in the room stated that the groundfishing industry in Hancock County, which was one of the top fisheries in New England in the 1850s/1860s, was all but gone. Today, only three boats are actively groundfishing out of Bar Harbor. Many in the room felt that lobster fishermen, many of whom were once groundfishermen, would be the only ones able to participate in the tagging program.

Several thought that it would be difficult to tag enough fish unless lobstermen dedicated a day to fish specifically for cod. An alternative suggestion was to have a designated boat in the area that could travel among commercial vessels and collect tags and fish.

There also was some support for having party boats and recreational fishermen involved in tagging effort.

One fisherman asked if the current inshore survey could be expanded to also include tagging cod fish.

How many fish can fishermen handle in a day?

In the Downeast area, some fishermen said they catch anywhere from 1 to 500 cod in their lobster traps weighing between two and five pounds each. The average size caught is around 15 to 16 inches. One fisherman added that when shrimping he picks up 1 to 500 fish in a tow, the majority of which are juveniles. In the past he used to only get about three or four a day.

Many in the room felt that they could catch medium and small cod (about 400 to 500 pounds a day), but could easily tag 50 to 100 fish a day in the summer.

What is a fair compensation for fishermen on a dedicated trip?

Most fishermen present felt that $1,500 to $2,000 would be fair compensation for about a 50 foot dragger. Since there are very few groundfish fishermen left in the area, they felt that lobstermen, if paid $1,500 a day, could do a dedicated trip and jig for cod (two man boat).

One participant asked if a day of tagging could be credited towards use of groundfish permits. This would create an incentive for fishermen from this area to participate in the program. Currently the amount of cod found is this area is extremely low and to get around closures fishermen need to travel far offshore, which is not possible for small boats, so many people are not fishing for groundfish.

How do we enhance rate of tag returns?

There was quite a bit of discussion about survivability of cod fish. One fisherman said that when he catches cod and puts them in his lobster live well, they all die. Another fisherman pointed out that lobster deplete the water of oxygen. Cod must be put in separate tanks to survive and must not be brought up through the thermocline.

A suggestion was made that a cooperative agreement should be signed between the United States and Canada to allow U.S. fishermen into Canadian waters if they were participating in the tagging program.

A point was made that all tags put into the water should be the same color, as a disincentive for people to discard them to protect local interests.

Who is interested in participating?

A show of hands revealed that if tagging could provide some form of supplemental income for these fishermen, many would be interested in participating.

Glossary

Abundance: The weight or number of fish that make up a stock.

Acoustic: The use of sound waves projected into the water to locate an object (be it a tag emitting a sound wave to a receiving device, or a vessel emitting sound waves that locate fish)

Age and growth studies: Include studies that can determine the age of fish and their rate of growth.

Archival Tags: Also referred to as Data Storage Tags. Include devices attached to fish that can record various data such as position, temperature, and water depth. Once the tag is retrieved, the information can be downloaded onto a computer.

Cod Distribution: The position, arrangement, or frequency of occurrence (as of the members of a group) of cod over an area or throughout a space or unit of time. The natural geographic range of an organism.

Confidence Level: The true value within a given probability. Level of certainty obtained about program/project results based on the quality of available data.

Conventional Tag: Simple tags which are generally attached to the exterior of a fish (e.g., spaghetti tags, t-bar tags, etc.). These tags are usually relatively inexpensive and provide information on basic movement patterns. For instance, whether a fish moved from point A to point B.

Dedicated trips: Research trips aboard a commercial vessel where fishermen do not land their catch, but tag and/or release all the fish.

Electronic Tag: Generally a more expensive tag than conventional tags such as t-bars. Electronic tags provide much more detailed information about fish movement patterns (e.g., water temperature, salinity levels, and pressure changes, etc.). Examples of electronic tags include acoustic and archival tags.

Exempted/Experimental Fishery Permit (EFP): Allows a permit holder/owner to be exempt or excused from regulations in order to conduct a research project or experimental fishery.

Genetic Studies: Collecting and analyzing DNA to discriminate among individuals, populations, or species and to monitor representatives of these groupings through time.

Intra-annual variability: The difference in results from year to year.

Migration: To pass usually periodically from one region or climate to another for feeding or breeding, as opposed to Emigration in which an organism leaves one area for another.
Otoliths: Bony structures located inside a fish's head that are used to tell the age of the fish. The otoliths have annual growth marks, or annuli, that a scientist can read with a microscope. For example, in temperate waters, fish growth is fast during the summer months when water temperatures are warm, and slow during the cold winter months. A year of growth is defined as one summer zone plus one winter zone. On otoliths, these zones are identified as alternating opaque and translucent bands.

Population: The number of individuals of a species living in a restricted area, or the total number or combined weight of members of a species present in a given area.

Pre-recruits: Fish not yet recruited into the harvestable fishery. For the purpose of cod we are assuming those fish 16 to 19 inches in length.

Recruitment: The amount of fish added to the exploitable stock each year due to growth and/or migration into the fishing area. For example, the number of fish that grow to become vulnerable to the fishing gear in one year would be the recruitment to the fishable population that year. This term is also used in referring to the number of fish from a year class reaching a certain age. For example, all fish reaching their second year would be age two recruits.

Request for Proposals (RFP): A process by which a funder asks individuals or groups to submit a proposal or bid for work or research. The RFP is reviewed by the funder who then determines whether or not to grant funding for that work or research.

Return rate: The rate at which tags are retrieved from fish over time.

Spatial Studies: Relating to where fish may be in a space/location.

Stock: A part of a fish population usually with a particular migration pattern, specific spawning grounds, and subject to a distinct fishery. A fish stock may be treated as a total or a spawning stock. Total stock refers to both juveniles and adults, either in numbers or by weight, while spawning stock refers to the numbers or weight of individuals which are old enough to reproduce.

Stock affinity: The likelihood of a stock consistently remaining in an area.

Stock Assessment Review Committee (SARC): A panel of stock assessment experts who review stock assessments. The Northeast Regional Stock Assessment Workshop or SAW is a formal scientific peer-review process for evaluating and presenting stock assessment results to managers. The SAW protocol is used to prepare and review assessments for fish stocks in the offshore US waters of the northwest Atlantic. Assessments are prepared by SAW working groups (federally led assessments) or technical assessment committees (state led assessments) and reviewed by the SARC.

Temporal Studies: Relating to where fish may be during a certain time.

US Trawl Surveys: National Marine Fisheries Service research vessels survey from Cape Hatteras to the Scotian Shelf. Data collected is vital for assessment and management. Most of the trawl survey gear is designed, built, and tested by NMFS. The data collected serves to monitor recruitment, abundance and survival of harvestable sizes, the geographic distribution of species, ecosystem changes, biological rates of the stocks and to collect environmental data.